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THE PRODUCTION OF SWEET BREAD SAFE FOR DIABETICS REFERRING TO SNI 01-3840-1995

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ABSTRACT

Sweet bread for diabetes is whole wheat bread rich in fiber, B vitamins, and phytochemicals. The content of whole wheat flour and corn flour has a lower glycemic index, which helps manage blood sugar levels. The production of sweet bread involves variations of palm sugar in amounts of 10, 20, 30, 40, and 50 grams, as well as variations in whole wheat and corn flour. Testing to ensure the bread is suitable for consumption includes tests for moisture content, ash content, microbial contamination, and organoleptic tests. From the test results, the moisture content in sample 7, using whole wheat flour with 10 grams of palm sugar, was 27.18%, while sample 16, using corn flour with 5 grams of palm sugar, had a moisture content of 28.80%. The best ash content results were found in sample 7 with whole wheat flour and 10 grams of palm sugar, yielding 0.40%, and sample 16 with corn flour and 5 grams of palm sugar, yielding 0.20%. The organoleptic test results were satisfactory, as indicated by blood sugar checks in diabetic patients, and the best microbial contamination test result was scored at 4.

Keywords: *Bread, Diabetes, Palm Sugar, Whole Wheat Flour, Corn Flour*.

INTRODUCTION

Diabetes is a metabolic disease characterized by an increase in blood sugar levels due to a decrease or cessation of insulin production or a reduced sensitivity of tissues to insulin. Uncontrolled blood sugar levels can lead to serious complications such as blindness, retinopathy, and heart disease. In Indonesia, the number of diabetic patients continues to rise, increasing the government's burden in the form of subsidies for patient treatment. This issue can be addressed through disease prevention measures, including lifestyle modifications such as regular exercise and a regulated diet (Suryawati, 2021).

The primary treatment for diabetes is lifestyle changes, particularly adopting a healthy and balanced diet. The application of a proper diet is one of the main components of successful diabetes management. However, it often becomes a challenge in diabetes care because it requires the patient's compliance and motivation (Setyorini, 2017).

Diabetes requires early diagnosis to be promptly treated. The goal of early diagnosis is to maintain balanced blood sugar levels and control the symptoms to prevent complications. Type 2 diabetes mellitus can be prevented by identifying risk factors, one of which is changing eating habits, sleep patterns, activity levels, and stress management. Preventive efforts for type 2 diabetes mellitus include modifying eating habits, such as choosing high-fiber foods. Dietary fiber, often referred to as dietary fiber or diet fiber, is a consumable plant component composed of carbohydrates resistant to digestion. In the small intestine, dietary fiber can slow down stomach emptying and also reduce blood sugar absorption. Diabetic patients in Indonesia are advised to consume 20-35 grams of fiber per day (Soelistijo et al., 2019).

The demand for food increases each year in line with population growth. This affects the need for commonly consumed food ingredients. One of these ingredients is wheat, which is often used as the main ingredient for noodles and bread. According to a report by the United States Department of Agriculture (USDA), in 2012, Indonesia became the second-largest wheat importer after Egypt, according to the Central Bureau of Statistics (BPS). In 2014, Indonesia's wheat import volume increased to 7.43 million tons from 6.37 million tons in 2013. Since 2008, efforts to meet wheat demand have led Indonesia to develop wheat cultivation in areas with conditions similar to optimal wheat-growing regions, typically at an elevation of >800m above sea level with temperatures ranging from 22-24°C (Febrianto, 2014).

Wheat flour is developed from whole wheat seeds that undergo a thorough milling process, retaining the wheat bran and germ. Whole wheat flour is processed without refining and contains

higher levels of minerals and fiber than regular wheat flour. Wheat also contains lower sugar levels compared to other carbohydrate sources, making it suitable for consumers following a diet program (Widayat, 2015).

Corn is another carbohydrate source, second to rice. In 2015, Indonesia produced 19,612,435 tons of corn (BPS, 2015). This abundant corn production can be processed into corn starch, also known as cornstarch. Cornstarch is typically used as a thickener in sauces, soups, and as an ingredient in cookies and cakes. To enhance the value of cornstarch, it is known to contain about 74-76% amylopectin and 24-26% amylose (Radhiyatullah et al., 2015). Flour with high amylopectin content yields products that are crispy, light, and brittle. Cornstarch can be used as a binder, as it can absorb water in dough, reducing shrinkage during cooking. According to Suarni (2009), corn flour can be used in flour-based food processing, especially in products that do not require significant leavening. One such product that uses wheat flour and does not need much leavening is sticks (Nisa, 2021).

Bread is a culinary product derived from the fermentation of wheat flour with yeast or other leavening agents and then baked. It holds a special place among the wide variety of food choices (Mudjanto and Yulianti, 2004).

One of the key secrets to leavening bread is yeast, a baking ingredient that needs to be activated before being added to the dough (Angelina Melisa, 2022).

In a previous study, wheat bread was processed with the addition of pumpkin. The importance of a healthy lifestyle to prevent diabetes was highlighted. In this study, the community service program based on bread products resulted in bread made from wheat and pumpkin, which has been clinically and experimentally proven (in various other studies) to have antidiabetic benefits (Suryawati, 2021).

RESEARCH METHOD

Material and Equipment

In this study, the tools used include scales, a sieve, a mixing bowl, a spatula, a baking tray, an oven, newspapers, and jars. The materials utilized consist of wheat flour, corn flour, palm sugar, butter, yeast, eggs, salt, liquid milk, and bread improver.

Preparation of sweet bread

Accurately measuring and weighing all the ingredients. In a large bowl, mix the dry ingredients, including flour, yeast, and bread improver. Then, add the egg yolks, liquid palm sugar, and liquid milk to the flour mixture, stirring until well combined. Cut the butter into small pieces and add salt to the mixture, kneading until it forms a crumbly texture. Place the dough in a large bowl, cover it with a clean cloth, and let it ferment until it doubles in size, approximately 2 hours. Once risen, transfer the dough to a flat surface and roll it out with a rolling pin. Roll the dough from the longer side, similar to making a Swiss roll. Cut the rolled dough into pieces about 2-3 cm thick and place them in a buttered baking tray. Allow the bread pieces to rise again for about 30-45 minutes. Preheat the oven and bake the bread at a temperature of 180°C for about 20-25 minutes, or until golden brown. Let the bread cool before serving and spread with jam as desired. Afterward, conduct tests for fat content, moisture, sugar, microbial contamination, and organoleptic properties.

Testing

The moisture content analysis is conducted using an oven. First, weigh an empty dish that has been heated in an oven at a temperature of 105 °C. Prepare the specified sample, then add approximately 5 g of the sample into the weighed dish. Heat the dish containing the sample in the oven at 105 °C for 2 hours. After 2 hours, remove the dish and allow it to cool slightly before placing it in a desiccator for 15 minutes, then weigh it.

The ash content test aims to determine the amount of ash produced after the briquettes undergo the combustion process. The procedure for measuring the ash content of the produced briquettes is as follows: weigh the dish or sample container using an analytical balance. Next, weigh each briquette sample. Dry the sample in the dish in an oven at 600 °C for 5 hours. Cool the material in a desiccator, then weigh it and subtract the weight of the dish. Take a sample for combustion. After the combustion process is complete, weigh the resulting ash waste using a scale to determine the ash content produced.

To conduct a microbial contamination test, first connect the power supply and turn on the PC. Select the colony counter scan application. Prepare the sample to be tested, filling it in a dish placed under the light of the scanner lamp. Open the scanner application, select the name of the bacteria to be examined, adjust the area and image, then choose 'count' and validate if everything is correct.

The researcher prepares the room and equipment used for the organoleptic test, including test forms, writing instruments, mineral water glasses, and the sweet bread product. A total of 20 panelists participate in the organoleptic test. The panelists sit separately with adequate distance between each other, and each is provided with a test form and writing materials. The panelists receive instructions on how to conduct the organoleptic test, including how to fill out the form and the etiquette to follow during the testing process. The panelists evaluate the taste, aroma, texture, and overall acceptance of the sweet bread product.

Once completed, the researcher collects the test forms and allows the panelists to leave the room. The data obtained from the test results are then processed and analyzed, with the preference-dislike ratings expressed in a hedonic scale.

RESULT AND DISCUSSION

1. Water Content

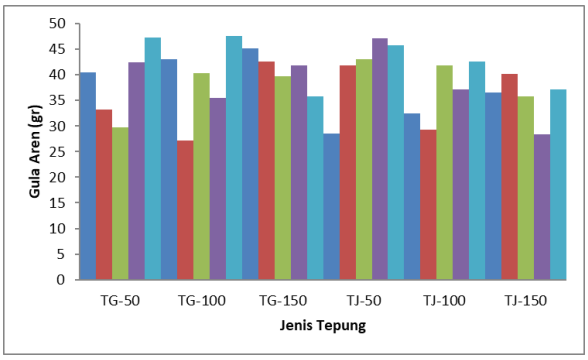

Figure 1. The Effect of Water Content in Bread

The provided data shows the effect of varying amounts of palm sugar on the moisture content of bread made using different types of flour, namely TG-50, TG-100, TG-150, TJ-50, TJ-100, and TJ-150. Each type of flour was tested with five variations of palm sugar (5, 10, 15, 20, and 25 grams), and the resulting moisture content in the bread was recorded. Generally, an increase in the amount of palm sugar tends to increase the moisture content in the bread, although this effect varies depending on the type of flour used.

For flour TG-50, the highest moisture content was recorded with the addition of 20 grams of palm sugar, reaching 50.24%, although it slightly decreased with the addition of palm sugar up to 25 grams. Flour TG-100 showed the most significant increase in moisture content with the use of 20 grams of palm sugar, achieving a moisture content of 59.32%. However, further addition of palm sugar did not always result in higher moisture content. For flour TG-150, the highest moisture content was noted with 15 grams of palm sugar (49.41%), followed by a decline with additional palm sugar.

Flours coded TJ exhibited a somewhat different pattern. Flour TJ-50 experienced an increase in moisture content up to 20 grams of palm sugar, with the highest moisture content being 47.55%. However, flours TJ-100 and TJ-150 indicated that the highest moisture content did not always occur at higher amounts of palm sugar. In TJ-100, the highest moisture content was recorded at 15 grams of palm sugar, reaching 51.90%, while in TJ-150, the highest moisture content was noted at 5 grams of palm sugar (50.36%), with a decrease in moisture content observed as more palm sugar was added.

From this analysis, it can be concluded that the addition of palm sugar has a significant influence on the moisture content of the bread, but this pattern varies depending on the type of flour used. Flour TG-100 has the highest water absorption capacity at higher levels of palm sugar, while the TJ flours demonstrate a different trend, with some types of TJ having the highest moisture content at lower amounts of palm sugar. This data is crucial for determining the optimal formulation in bread production to achieve the desired moisture content.

2. Ash Content

The ash content in bread represents the amount of sample that does not burn during the combustion process. The remaining material can create a crust that may lead to corrosion, affecting the equipment used. Therefore, the lower the ash content in the bread, the better the quality of the bread produced. Determining the ash content helps identify the amount of unburned material. The ash contained in solid fuel is composed of unburned or residual minerals. The ash content value in the bread can be seen in Figure 4.3.

3. Sugar Content in Bread

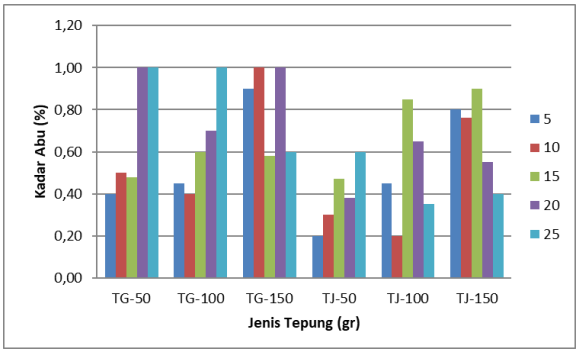

Figure 2. The Effect of Ash Content in Bread

The data analysis indicates the variation of ash content in flour concerning the sugar content in bread using different types of flour and concentrations of palm sugar. For flour TG-50, the ash content varies between 0.40% and 1.00%, with the sugar content ranging from 97.80 g to 107.88 g. Flour TG-100 shows a slightly higher ash content, between 0.40% and 1.00%, with sugar content varying from 93.70 g to 109.65 g. Meanwhile, flour TG-150 shows ash content between 0.58% and 1.00%, with measured sugar content ranging from 92.85 g to 105.08 g.

For flour TJ-50, the recorded ash content is between 0.20% and 0.60%, accompanied by sugar content ranging from 95.47 g to 109.50 g. Flour TJ-100 exhibits ash content between 0.20% and 0.85%, with sugar content from 95.67 g to 107.00 g. Flour TJ-150 shows ash content between 0.40% and 0.90%, with sugar content varying from 97.56 g to 108.00 g.

Overall, the data indicate that an increase in ash content in flour does not consistently affect the sugar content in bread. Some flours with higher ash content show higher sugar content, while others do not exhibit the same pattern. This suggests that, in addition to ash content, other factors in the flour and the bread-making process also influence the final sugar content in the bread product.

4. Organoleptic Test

The tests conducted in this research aim to obtain the most preferred shortening. The organoleptic test was carried out using a hedonic scale to determine which lecithin content and mixing time are favored by the panelists. The parameters used in this study are taste, aroma, color, and texture.

The purpose of the organoleptic test is to evaluate the sensory characteristics, namely color, aroma, texture, and taste of various food samples. Based on the organoleptic test data in the table above, it can be seen that each sample has been assessed using a varied scale for the four evaluation indicators.

5. Microbial Contamination Test

The Microbial Contamination Test refers to the contamination in processed food that originates from microbes which can harm human health. Microbial contamination of food can occur intentionally or unintentionally. These unwanted substances may come from the environment or from processes involved in food processing.

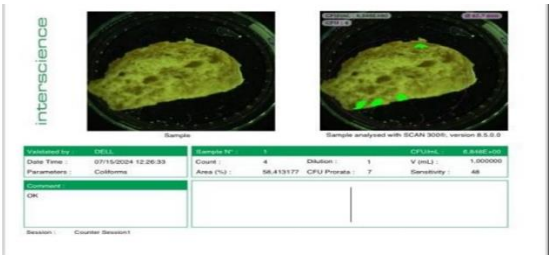

Figure 3. Results of Colony Counter Analysis on 10 g of Palm Sugar with Wheat Flour.

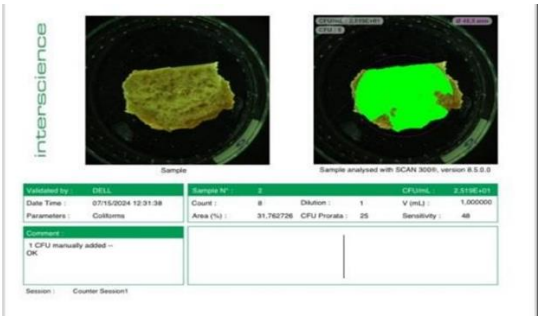

Figure 4. Results of Colony Counter Analysis on 10 g of Palm Sugar with Wheat Flour.

Contamination that occurs in food can transform it into a medium for disease. The Colony Counter Test is conducted to determine the number of bacterial colonies that grow within the sample. This analysis is performed to identify several microbes present in sweet bread, with values that exceed the standards set by SNI (Indonesian National Standards).

6. The Effect of Sugar Levels Before and After Eating Bread

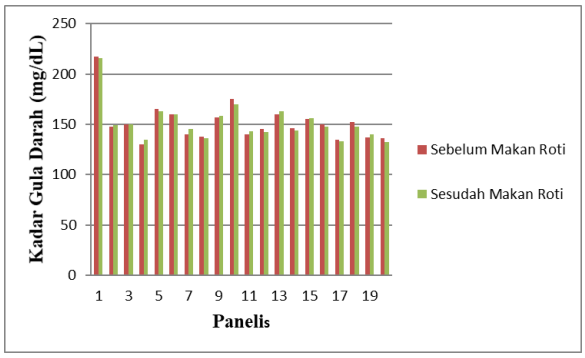

Figure 5. Results of Colony Counter Analysis on 10 g of Palm Sugar with Wheat Flour.

In this study, the impact of bread consumption on blood sugar levels was analyzed by measuring glucose levels before and after eating bread. The results showed that the average blood sugar level before consuming bread was 138.32 mg/dL, while one hour after eating the bread, the blood sugar level decreased to 128.47 mg/dL. This decrease in sugar levels aligns with the fundamental principles of glucose metabolism, where the consumption of food containing glucose leads to an increase in blood sugar levels. After eating, the pancreas releases insulin to help regulate blood sugar levels by allowing glucose to enter the body's cells (Kumar et al., 2019). Insulin functions to lower blood sugar levels after meals, and this process can lead to a measurable decrease in blood sugar within one hour after consumption (American Diabetes Association, 2020). Additionally, the type of bread consumed also plays a role, as bread with a high fiber content can slow digestion and glucose absorption, contributing to blood sugar control (Slavin, 2013). Therefore, the results of this study indicate the potential effects of blood sugar regulation that may be associated with bread consumption, linked to metabolic processes and insulin response.

CONCLUSIONS

Based on the research conducted, the following conclusions can be drawn: The addition of palm sugar to bread significantly affects moisture content, although the effect varies depending on the type of flour used. In the case of TG-50 flour, the highest moisture content was recorded at 20 grams of palm sugar, while TG-100 flour showed maximum moisture at 20 grams, reaching 59.32%. However, TG-150 and TJ flours indicated that the highest moisture content does not

always occur with higher amounts of palm sugar, as some types of flour exhibited a decrease in moisture with further additions of sugar. This suggests that the optimal formulation for bread moisture is highly dependent on the combination of flour type and the amount of palm sugar used. Additionally, the ash content in flour did not show a consistent pattern in its influence on sugar levels in bread. Although some flours with higher ash content exhibited higher sugar levels, this pattern was not universal, indicating that other factors in the bread-making process, such as the type of flour and production techniques, also play a significant role in determining the final sugar content of the bread product. Organoleptic tests revealed that the bread samples were generally well-received by panelists, with an average assessment score of 84.7 for color, aroma, texture, and taste. The sample with the highest score for each indicator displayed the most preferred sensory characteristics, particularly the highest-rated sample (A-10), which demonstrated superior sensory quality.

Lastly, the study indicated that the average blood sugar level before consuming bread was 138.32 mg/dL, which decreased to 128.47 mg/dL one hour after consumption. This reduction is consistent with the fundamental principles of glucose metabolism, where insulin helps lower blood sugar levels post-meal. Furthermore, bread with a high fiber content can slow glucose absorption, contributing to better blood sugar control (Slavin, 2013).

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