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The Effect Of Tofu Drain Flour Substitution On *Cooking Loss* And Sensory Quality Of Onion Cake

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Abstract

This study aims to analyze the effect of tofu dregs flour substitution on cooking loss and sensory quality of onion cake. This study was conducted at the Culinary Arts Education Study Program, Faculty of Engineering, Jakarta State University. The study period began from September 2024 to December 2025. This study used an experimental method with onion cake samples substituting tofu dregs flour at percentages of 20%, 30%, and 40%. Sensory quality testing in this study was conducted on 45 semi-trained panelists who assessed all product sensory quality attributes. Based on the results of the statistical hypothesis test of sensory quality using the Kruskal-Wallis test, it showed that there was no effect of onion cake substitution of tofu dregs flour at percentages of 20%, 30%, and 40% on the sensory quality aspects of color, tofu dregs aroma, tofu dregs taste, savory taste, and texture. Based on the results of the statistical hypothesis test of the cooking loss test using the ANOVA test, it showed that there was no effect on onion cake substitution of tofu dregs flour at percentages of 20%, 30%, and 40%. The conclusion of this study is to recommend onion cakes made from 30% tofu dregs flour as a substitute for tofu dregs flour to be further developed as a product that has sales value and efforts to use tofu dregs flour as a local food ingredient.

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1. INTRODUCTION

Tofu is a source of vegetable protein because it is made from soybeans, which have high nutritional value. Its relatively low price makes it a popular food consumed by various groups of people, from upper, middle-, and lower-income groups. Therefore, the tofu industry needs to increase its production capacity annually due to the high consumption of tofu-based foods. Tofu is a source of vegetable protein with good nutritional quality. 100 grams of tofu contains 80 calories of energy, 82.2 g of water, 10.9 g of protein, 0.8 g of carbohydrates, and 4.7 g of fat (Putri et al., 2022).

However, the process of making tofu from soybeans produces waste in the form of tofu dregs. Tofu dregs are solid waste produced from processing soybeans into tofu. When fresh, tofu dregs have a soft texture, white color, and a distinctive soybean aroma. The more tofu is produced, the more tofu dregs are produced. Tofu dregs are perishable and can only last for approximately three days if left unprocessed. However, tofu dregs still contain high nutritional value. 100 grams of tofu dregs contain 414 calories of energy, with a composition of 26.6 grams of protein, 18.3 grams of fat, and 41.3 grams of carbohydrates. (Broto et al. 2021).

Although tofu dregs generally contain high levels of protein, their utilization is not optimal due to the limited public knowledge regarding the nutritional value contained in this waste. If tofu dregs are disposed of without proper handling, they will accumulate and have the potential to cause environmental pollution. According to Yustina and Abadi (2012), one way to utilize tofu dregs is by

processing them into flour. Compared to wheat flour, tofu dregs flour has a higher crude fiber content, thus contributing to meeting the community's fiber needs. Thus, processing tofu dregs into flour not only serves to reduce waste that has the potential to pollute the environment but also increases the nutritional value of the resulting food product (Wati, 2013). Sulistiani (2004) reported that tofu dregs flour contains 10.80% protein, 14.49% fat, and 59.95% carbohydrates.

Processing tofu dregs into flour has several advantages, including easier mixing or formulation with other ingredients, longer shelf life, and broader utility. The low water content of tofu dregs flour also extends its shelf life. Various innovations based on tofu dregs flour have been developed, such as crackers, sticks, cookies, and so on (Yuniarti et al., 2020). This flour can be further processed into a variety of food products, one of which is onion cake.

Onion cake is a traditional Indonesian food that is widely loved by the public. This product is widely offered as a snack or treat that can be enjoyed by people of all ages. Onion cake is often eaten as a side dish and is often found on holidays such as Eid. Onion cake is a product classified as a snack or treat made from wheat flour, onions, and additional spices. Onion cake has a crunchy texture, a savory taste, and is relatively easy to prepare and serve. Furthermore, onion cake is included in the category of snacks with a fairly long shelf life (Febryani and Andriani, 2025).

Based on this background, to utilize tofu waste and increase its economic value, tofu dregs can be processed into flour for use in making onion cakes. This research is expected to be an innovation from previous research, creating a functional food-based onion cake with greater appeal and nutritional value.

2. MATERIALS AND METHODS

2.1 Materials and tools

The ingredients used to make onion cake substituted with tofu dregs flour include wheat flour, tofu dregs flour, cornstarch, margarine, shallots, garlic, celery, salt, stock powder, and water. The tools used in this study include scales, bowls, measuring spoons, spatulas, cutting boards, knives, blenders, pasta makers, 100-mesh sieves, pans, ovens, and pasta cutters.

2.2 Research methods

This research was conducted using an experimental method and aimed to analyze the effect of tofu dregs substitution on cooking loss and the sensory quality of onion cakes. The experiment was conducted at three levels of tofu dregs flour substitution: 20%, 30%, and 40%. Observation parameters included the test of *cooking loss and* sensory quality (color, aroma of tofu dregs, taste of tofu dregs, savory taste, and texture).

2.2.1 Making tofu dregs flour

The method for making tofu dregs flour refers to research conducted by Sahputra (2023) and Putri et al. (2022). The process of making tofu dregs flour begins with boiling the tofu dregs for 15 minutes to ensure that any bacteria in the tofu dregs are killed. After that, the tofu dregs are squeezed using a wringing cloth or cheese cloth. *The* next step is steaming for 45 minutes. After steaming, the tofu dregs are squeezed again to reduce the remaining water content. The tofu dregs are then spread out on a baking sheet and baked in an oven at 180°C for 40 minutes, turning every 10 minutes to prevent burning. Next, the tofu dregs are pureed using a blender and sieved through a 100-mesh sieve to obtain a finer flour.

2.2.2 Making onion cake using tofu dregs flour as a substitute

In this study, the method for making onion cakes using tofu dregs flour substitutes refers to Wawawiati (2022) with several modifications, particularly in the weight of the ingredients used. The cake-making process begins by weighing the ingredients, mixing the flour, salt, and stock powder, and then stirring thoroughly. After that, celery and margarine

are added, then stirred again. Next, the mashed shallots and garlic are mixed with water, and then the dough is processed until smooth. The dough is divided into several portions, thinned using a pasta maker, and cut uniformly with a pasta cutter. Next, heat the oil, then fry the dough until cooked, drained, and stored in a closed container. The composition of the ingredients is shown in Table 2.1.

Table 2.1 Standard Formula for Onion Cake

Material	Gram	%
Medium protein wheat flour	320	100
Cornstarch	30	9,4
Margarine	45	14
Salt	3	0,9
Garlic	15	4,7
Red onion	23	7,2
Powdered stock	3	0,9
Celery	7	2,2
Air	120	37,5

Source: Wawawiati, 2022. 35 Favorite Cookie & Kletikan Recipes

2.3 Data collection techniques

2.3.1 Test Cooking *loss*

Cooking loss is the reduction in weight of a food product due to the cooking process. Measurement of cooking *loss.* This was done by calculating the difference between the initial and final weight of the onion cake after the frying process. This measurement was repeated three times. Measure the cooking *loss* on the onion cake using scales, then the resulting data will be calculated as a percentage using the formula:

$$\% \text{ Cooking loss} = \frac{A-B}{A} \text{ x } 100\%$$

Information:
A = Weight before frying
B = Weight after frying

2.3.2 Sensory quality test

The sensory quality test was conducted by 45 semi-trained panelists, students of the Culinary Arts Education Program at Jakarta State University who had taken the Organoleptic course. Each panelist was given a product sample to evaluate based on five organoleptic aspects: color, tofu dregs aroma, tofu dregs taste, savory taste, and texture.

2.4 Data analysis

Data analysis: The ANOVA test was used in this study. If significant differences between treatments were found in the data, Duncan's further test was used. This test aims to identify which treatments showed significant differences. Meanwhile, sensory quality data were analyzed using the Kruskal-Wallis test at a significance level of 0.05, followed by the Tukey test at a 95% confidence level ($\alpha = 0.05$) if the results showed significant differences.

3. RESULTS

3.1 *Cooking loss*

Analysis *cooking loss* onion cake substituted with tofu dregs flour can be seen in figure 3.1 below
Figure 3.1 Test Results *Cooking Loss* Onion Cake Substituted with Tofu Dregs Flour

The results of the analysis show that the average *cooking loss* with the highest percentage found in the onion cake treatment with 40% tofu dregs flour substitution. *Cooking loss* in onion cakes, the addition of tofu dregs flour did not provide a significant difference. Based on the table above, it can be concluded that the higher the substitution of tofu dregs flour in onion cakes, the higher the average percentage of cooking loss. This is in line with the statement made by Yuwono and Zulfiah (2015) that an increase in the percentage of tofu dregs flour substitution is directly proportional to the increase in the cooking loss value in analog rice.

Cooking loss occurs due to the loss of water content during the cooking process. This can occur due to the low water-holding capacity of the onion cake dough. Research by Saripudin and Mardesci (2016) states that the higher the gluten content, the greater the water-holding capacity of the wonton sticks. Meanwhile, tofu dregs flour, which does not contain gluten like wheat flour, will reduce the gluten content in the resulting onion cake, resulting in low water-holding capacity and high-water content. *Cooking loss* during the cooking process.

3.1 *Sensory* quality

The results of the analysis of sensory quality obtained through organoleptic assessment are presented in the following table.

Table 3.1 Organoleptic Test Results of Onion Cake Substituted with Tofu Dregs Flour

Evaluation Aspects	**Onion Cake Substituted with Tofu Dregs Flour**		
	20%	**30%**	**40%**
Color	4,60	4,47	4,47
Aroma of Tofu Dregs	4,53	4,40	4,27
Taste of Tofu Leftovers	4,73	4,40	4,20
Savory Taste	4,33	4,47	4,27
Texture	4,80	4,67	4,20

3.2.1 Color

Hypothesis analysis using the Kruskal-Wallis test showed that the percentage of tofu dregs flour substitution did not have a significant effect ($p>0.05$) on the color of the onion cake. The highest average value in the organoleptic test of the color aspect was found in the 20% treatment (4.60), with a golden yellow indicator. Meanwhile, the onion cake substitution with tofu dregs flour with 30% and 40% treatments had a score of 4.47 with a brownish yellow indicator. This research supports the results of previous studies which stated that the higher the proportion of tofu dregs flour, the greater the effect on the decline in color quality, marked by a tendency towards brown (Wati, 2013).

3.2.2 Aroma of tofu dregs

The results of the Kruskal-Wallis test showed that the variation in the percentage of tofu dregs flour substitution had no significant effect ($p>0.05$) on the aroma of tofu dregs.

The highest average value in the assessment of the aroma aspect of tofu dregs in tofu dregs flour substitution onion cakes was the 20% treatment (4.53) which was included in the category of no tofu dregs aroma. While the lowest value was the 40% treatment (4.27) which was included in the category of less tofu dregs aroma. Based on the results of the study by Fransiska and Deglas (2017), the increase in the percentage of tofu dregs flour substitution was directly proportional to the intensity of the tofu dregs aroma in the product. However, due to the addition of ingredients such as onions, butter, and celery, the aroma of tofu dregs flour could be disguised.

3.2.3 Tofu dregs taste

Hypothesis testing using Kruskal-Wallis showed that the percentage of all treatments did not have a significant effect ($p>0.05$) on the taste of tofu dregs in onion cakes. The average value showed that the onion cake with 20% tofu dregs flour substitution had the highest score with a score of 4.73 which was included in the category of no tofu dregs taste. Meanwhile, the lowest percentage was the onion cake with 40% treatment (4.20) which was included in the category of less tofu dregs taste. This is because the more tofu dregs flour, the more tofu dregs will be tasted in the onion cake. The results of this study support the statement of Fransiska and Deglas (2017) that the greater the proportion of tofu dregs flour substitution, the stronger the distinctive tofu taste detected in the product. However, the influence of other ingredients such as onions, salt, and margarine made the taste of tofu dregs flour not so strong.

3.2.4 Savory taste

Based on the results of the hypothesis analysis using the Kruskal-Wallis test, it was found that the percentage of tofu dregs substitution did not have a significant effect on the savory taste aspect tested ($p>0.05$). The highest average value of onion cakes with tofu dregs flour substitution was found in the 30% treatment (4.47) which was included in the savory category. Meanwhile, the lowest value was the 40% treatment with a score of 4.27 which was included in the fairly savory category. As explained in the research of Viora, et al. (2025), the use of tofu dregs flour in the dimsum skin formulation can contribute to the savory taste. This is because the protein, fiber, and residual soybean components contained in tofu dregs have a distinctive taste.

3.2.5 Texture

The Kruskal-Wallis test showed no significant effect ($p>0.05$) of tofu dregs flour substitution on the texture of onion cookies. The 20% treatment produced the highest average value (4.80) which is included in the crispy category. Meanwhile, the 40% treatment produced the lowest average value (4.40) which is included in the fairly crispy category. This is in accordance with Kaahoao, et al. (2017) In the process of making cookies with tofu dregs flour substitution, the higher the amount of tofu dregs flour added, the lower the level of crispiness produced. This is due to the higher fiber content of tofu dregs flour compared to wheat flour. Consequently, the more tofu dregs flour used, the higher the water content in the cake, thereby reducing the crispiness.

4. CONCLUSION

Based on research on making onion cakes using tofu dregs flour as a substitute, the best formula was obtained with a tofu dregs flour percentage of 20%, 30%, and 40%. The results of this research analysis indicate that the use of tofu dregs flour substitution of 20%, 30%, and 40% can be used as an alternative in making onion cakes because it has the desired results in terms of color, aroma, taste, and texture.

Based on the results of the test data collection *cooking loss*(reduction of water content) onion cake substitution with tofu dregs flour was carried out, it was found that the lowest average value was

found in onion cake substitution with tofu dregs flour with a percentage of 20%, then there was an increase in the water content *cooking loss* at 30% and 40% percentage.

Based on the results of data collection conducted on 45 panelists who were somewhat trained to provide an assessment of onion cakes substitution of tofu dregs flour with a percentage of 20%, 30%, and 40%. The results of the Kruskal Wallis test showed that in all aspects there was no effect of tofu dregs flour substitution in making onion cakes on sensory quality reviewed from the aspects of color, aroma of tofu dregs flour, taste of tofu dregs flour, savory taste, and texture. The best formulation was obtained at 30% substitution, with *cooking loss* by 4.54%. The product is characterized by a brownish-yellow color, a lack of tofu dregs aroma, a lack of tofu dregs taste, a moderately savory flavor, and a crispy texture.

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