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The Effect of Substituting Kimpul Taro Flour (Xanthosoma sagittifolium) on the Quality and Acceptability of Risoles: Family Welfare Education

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Abstract:
Risoles are a type of food that typically uses wheat flour as the main ingredient in their wrappers. The use of local food ingredients as substitutes can serve as an alternative to reduce the use of wheat flour, one of which is kimpul taro flour. This study aims to analyze the effect of substituting 0%, 25%, 50%, 75%, and 100% kimpul taro flour on the sensory quality and acceptability of risoles. This study employed an experimental method using a Completely Randomized Design (CRD), consisting of 5 treatments and three replicates. The study was conducted through sensory and hedonic tests by 30 untrained panelists. Data were analyzed using Analysis of Variance (ANOVA) at a significance level of 0.05, followed by Duncan's multiple range test when significant effects were found. The results showed that the substitution of kimpul taro flour had no significant effect on the sensory quality of the risoles—including their shape and aroma—but did have a significant effect on the grayish color of the risoles. The average grayish color value increased from 1.88 in the 0% treatment to 2.00 in the 25% treatment, to 3.00 in the 50% treatment, to 5.78 in the 75% treatment, and to 6.01 in the 100% treatment. In the acceptability test, the substitution of kimpul taro flour at the 25% treatment level still received good acceptance regarding the color quality of the risoles. Overall, kimpul taro flour has the potential to be used as a substitute ingredient in the production of risoles.

Introduction (مقدمة)

Risoles are a type of continental food commonly found in Indonesia and are classified as an "entrée" in continental cuisine. An entrée is an appetizer or light dish served before the main course and generally consists of a smaller portion than the main course. (Labensky, S. R., Hause, A. M., & Martel, P., 2023). In Indonesia, risoles have evolved into a popular snack with a wide variety of fillings, such as chicken ragout, vegetables, meat, cheese, and other ingredients. In addition to being served as a snack, risoles are also widely produced as frozen food products by micro, small, and medium-sized enterprises (UMKM) because they offer economic value and are in demand among various segments of the population.

The quality of risoles is determined not only by their filling but also by the quality of the risole wrapper. The risole wrapper serves as a casing for the filling while also imparting sensory characteristics to the product. A good risole wrapper has a smooth, thin, and elastic surface so that it does not tear easily during the rolling process and produces a crispy texture after being coated with breadcrumbs and fried. Conversely, a risoles wrapper that is too brittle will easily break during filling, while one that is too thick will reduce consumer acceptance. Therefore, the composition of the ingredients used in the risoles wrapper is a critical factor that determines the quality of the product's shape, color, flavor, texture, and overall appeal.

Several previous studies have shown that taro flour has the potential to be used as a substitute for wheat flour in various food products. Indraputri et al. (2024) demonstrated that substituting kimpul taro flour in fresh noodles affects physical and sensory characteristics, such as texture, color, aroma, and panelist acceptance. Aprillia et al. (2025) also found that taro flour substitution affected the sensory quality of perkedel, particularly aroma and taste. Meanwhile, Nur Aini et al. (2026) reported that substituting taro flour in marble cake significantly affected shape, color, aroma, texture, taste, and panelist preference. These findings indicate that the effect of taro flour varies depending on the product's characteristics. However, research on the use of kimpul taro flour in risoles wrappers—which are elastic before rolling and crispy after frying—remains limited. Therefore, this study was conducted to determine the optimal level of kimpul taro flour substitution that yields the best sensory quality and consumer acceptance of risoles.

The quality assessment of taro flour-substituted risoles in this study encompassed five organoleptic test parameters: shape, color, aroma, texture, and taste, as well as panelist acceptability. Based on preliminary studies previously conducted with various concentrations of taro flour substitution, the researchers were interested in conducting a study on the processing of risoles using taro flour substitution. Thus, this study aims to analyze the effect of taro flour substitution at levels of 0%, 25%, 50%, 75%, and 100% on the sensory quality of risoles.

Method (منهج)

Research Methods and Design

This study employed a true experimental design with a quantitative approach. The research design used was a Completely Randomized Design (CRD) with four treatments and three replications. The four treatments were 0% (X0) as the control, and taro flour substitutions of 25% (X1), 50% (X2), 75% (X3), and 100% (X4).

Time and Location of the Study

This study was conducted in July 2026 at the Culinary Arts Laboratory, Department of Family Welfare Sciences, Faculty of Tourism and Hospitality, Padang State University.

Tools and Materials

The equipment used in this study included a scale, a blender, a steamer, a measuring spoon, a spatula, teflon, a pastry brush, a stove, a mixing bowl, a saucepan, a measuring cup, a kitchen towel, a spoon, and a strainer. The ingredients used in this study are listed in Table 1 below:

Tabel 1 Ingredients for risoles made with taro flour as a substitute

Material	Treatment				
	0%	25%	50%	75%	100%
All-Purpose Flour	250 gr	187,5 gr	125gr	62,5 gr	-
Taro Flour	-	62,5	125 gr	187,5 gr	250 gr
Tapioca Flour	50 gr	50 gr	50 gr	50 gr	50 gr
Egg White	20 gr	20 gr	20 gr	20 gr	20 gr
Egg	80 gr	80 gr	80 gr	80 gr	80 gr
Water	700 ml	700 ml	700 ml	700 ml	700 ml
Margarine	20 ml	20 ml	20 ml	20 ml	20 ml
Salt	15 gr	15 gr	15 gr	15 gr	15 gr

Research Procedures

This study was conducted in three stages. The first stage was the preparation stage, which involved preparing and weighing all ingredients according to the formulation for each treatment. Second, the processing stage began with making the risoles wrappers: preparing all the ingredients, consisting of wheat flour, kimpul taro flour, tapioca flour, eggs, water, salt, and margarine. Next, all the ingredients were mixed and stirred until they formed a risoles wrapper batter. Once the batter was thoroughly mixed, it was strained through a fine sieve. The strained batter is then poured onto a non-stick flat griddle in sufficient amounts and spread out to form a thin sheet. The cooked risoles wrappers are then filled with the rougut filling and neatly rolled into long cylinders. The rolled risoles are then coated with the remaining rissole wrapper batter to act as an adhesive and subsequently coated with breadcrumbs. Finally, they are deep-fried in hot oil until the entire surface of the risoles turns golden yellow. The three stages of sensory evaluation were conducted through organoleptic testing of all samples by panelists. The stages of this study are presented in Figure 1 below:

The Process of Making Risoles

Data Analysis Techniques

The data in this study were obtained through organoleptic tests, which included a ranking test and a hedonic test. The tests were conducted by 30 semi-trained panelists, namely undergraduate and associate degree students majoring in culinary arts. Each sample was presented with a random code, and the panelists were then asked to conduct independent evaluations using the provided assessment instruments.

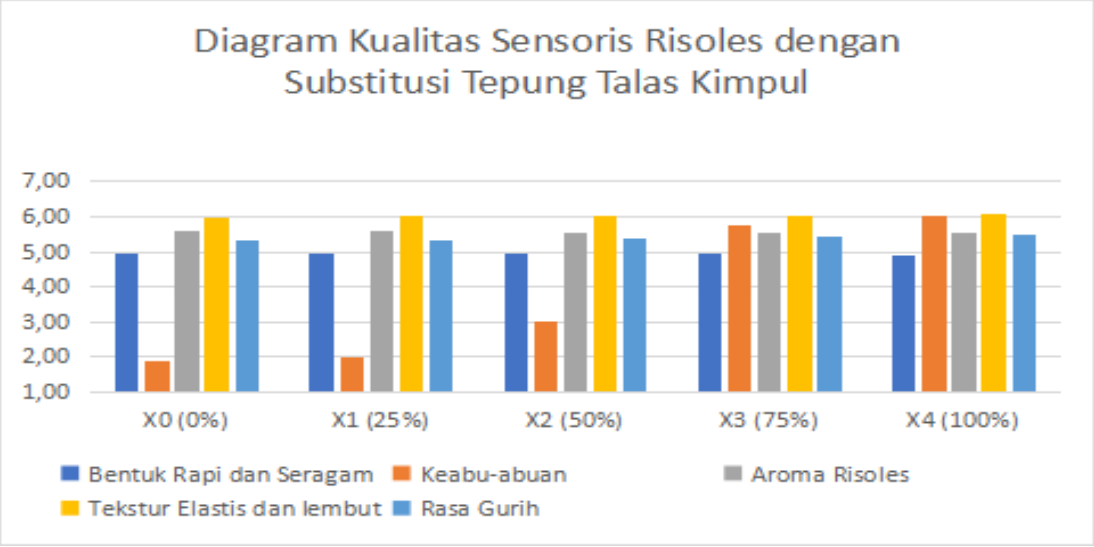
The data from the organoleptic tests were tabulated and analyzed using Analysis of Variance (ANOVA) to determine the effect of taro flour substitution on the quality of risoles. If the ANOVA results showed that the calculated F-value was greater than the critical F-value, the analysis continued with Duncan's Multiple Range Test (DMRT) to identify significant differences among the treatments.

Result (نتائج)

This study evaluated the quality of Risoles made with added taro flour through organoleptic testing, which included shape, color, aroma, texture, and taste.

Level Test

The following table shows the final results of the study on the texture of "risoles" made with taro flour as a substitute, as shown in Figure 1 below.



Gambar 1. Grafik Hasil Penelitian Uji Jenjang Kualitas Risoles Dengan Substitusi Tepung Talas

Geometric Quality

The results of the study show that substituting taro flour does not have a significant effect on the shape of risoles. This is supported by the results of the analysis of variance (ANOVA) in Table 2, which show that the calculated F-value is smaller than the critical F-value (0.29 < 2.45). Thus, substituting up to 100% taro flour still maintains the shape of the risoles. The mean values for all treatments fell into the "fairly neat and uniform" category, specifically X0 at 4.96, X1 at 4.96, X2 at 4.94, X3 at 4.96, and X4 at 4.92.

Tabel 2. Analysis of variance in the quality of risoles with taro flour substitution

SK	DB	JK	KT	Fhitung	Ftabel
					0,05
Sampel	4,00	0,63	0,16	0,29	2,45

Panelis	29,00	19,98	0,69	1,28	1,57
Galat/sisa	116,00	62,62	0,54		
Total	149,00	83,22			

This is consistent with the view of Lawless & Heymann (2022), who state that a good, uniform shape can enhance the perceived quality of food products and increase their appeal to consumers. Furthermore, according to Windyasmara (2022), the shape of a product is influenced by the mixing and molding processes of the dough. Using the same molding method can produce products with relatively neat and uniform shapes.

Grayish Color Quality

The results of the study show that taro flour substitution has a significant effect on the grayish color. This is supported by the results of the analysis of variance (ANOVA) in Table 3, which show that the calculated F-value is greater than the table F-value (328,46 > 2.45). Thus, the higher the taro flour substitution, the better the grayish color quality of the risoles. The mean values for all treatments in the grayish color category were as follows: X0 at 1.88, X1 at 2.00, X3 at 3.00, X3 at 5.78, and X4 at 6.01.

Tabel 3. Analysis of variance for grayish color quality with taro flour substitution

SK	DB	JK	KT	Fhitung	Ftabel
					0,05
Sampel	4,00	464,54	116,14	328,46	2,45
Panelis	29,00	10,31	0,36	1,01	1,57
Galat/sisa	116,00	41,01	0,35		
Total	149,00	515,87			

Based on the ANOVA results, which indicated a significant difference, the analysis continued with Duncan's test to identify the treatments that differed significantly. The results of Duncan's test in Table 4 show that each treatment differed across the groups; thus, it can be concluded that increasing the amount of taro flour had a statistically significant effect on the grayish color of the risoles. Treatment X4 produced a very grayish color, followed by X3, X2, X1, and X0.

Tabel 4. Duncan's test of the grayish color quality of risoles made with substituted taro flour

Treatment	Avarage	LSR + Average	Notation
X4 (100%)	6,01	6,31	a
X3 (75%)	5,78	6,09	a
X2 (50%)	3,00	3,32	b
X1 (25%)	2,00	2,33	c
X0 (0%)	1,88		d

The higher the substitution level of kimpul taro flour, the more pronounced the grayish color of the risoles becomes, consistent with the findings of Windyasmara (2022), which show that an increase in the substitution level of taro flour results in changes in the color value of nuggets, indicating that the use of taro flour can affect the visual characteristics of food products

Aroma Quality

The results of the study indicate that substituting taro flour does not have a significant effect on the aroma of risoles. This is supported by the results of the analysis of variance (ANOVA) in Table 5, which show that the calculated F-value is smaller than the critical F-value

(0.07 < 2.45). Thus, substituting up to 100% taro flour still preserves the aroma of risoles. The mean values for all treatments fell into the "fragrant" category: X0 was 5.58, X1 was 5.58, X2 was 5.57, X3 was 5.56, and X4 was 5.54.

Table 5. Analysis of Variation in the Quality of Risoles Flavor Using Taro Flour as a Substitute

SK	DB	JK	KT	Fhitung	Ftabel
					0,05
Sampel	4,00	0,03	0,01	0,07	2,45
Panelis	29,00	9,41	0,32	3,36	1,57
Galat/sisa	116,00	11,22	0,10		
Total	149,00	20,65			

The risoles production process in this study used instant kimpul taro flour, so the resulting taro aroma was not too strong. This is because the kimpul taro flour had undergone processing and drying before being used as a substitute ingredient. This is consistent with the findings of Yang et al. (2022), who stated that drying methods are known to affect the composition of volatile compounds in taro, so that aroma and flavor characteristics may change after the drying process.

Texture Quality

The results of the study indicate that substituting taro flour does not have a significant effect on the texture of risoles. This is supported by the results of the analysis of variance (ANOVA) in Table 6, which show that the calculated F-value is smaller than the critical F-value (0.59 < 2.45). Thus, substituting up to 100% taro flour still preserves the texture of the risoles. The mean values for all treatments in the "fragrant" category were as follows: X0 at 5.98, X1 at 6.02, X2 at 6.01, X3 at 6.03, and X4 at 6.07.

Tabel 6. Analysis of the Variation in Texture Quality of risoles with Taro Flour Substitution

SK	DB	JK	KT	Fhitung	Ftabel
					0,05
Sampel	4,00	0,13	0,03	0,59	2,45
Panelis	29,00	17,61	0,61	11,39	1,57
Galat/sisa	116,00	6,19	0,05		
Total	149,00	23,93			

This is consistent with Calle et al. (2021), who explain that kimpul flour (Xanthosoma sagittifolium) possesses functional starch properties that play a role in the gelatinization process and gel formation, thereby contributing to the texture of food products.

Taste Quality

The results of the study indicate that substituting taro flour does not have a significant effect on the flavor of nona manis cake. This is supported by the results of the analysis of variance (ANOVA) in Table 7, which show that the calculated F-value is smaller than the critical F-value (1.10 < 2.45). Thus, substituting up to 45% taro flour still preserves the flavor of nona manis cake, which is characterized by a rich, sweet taste. The mean values for all treatments in the pandan aroma and coconut milk categories were as follows: X0 = 5.32, X1 = 5.34, X2 = 5.40, X3 = 5.42, and X4 = 5.47

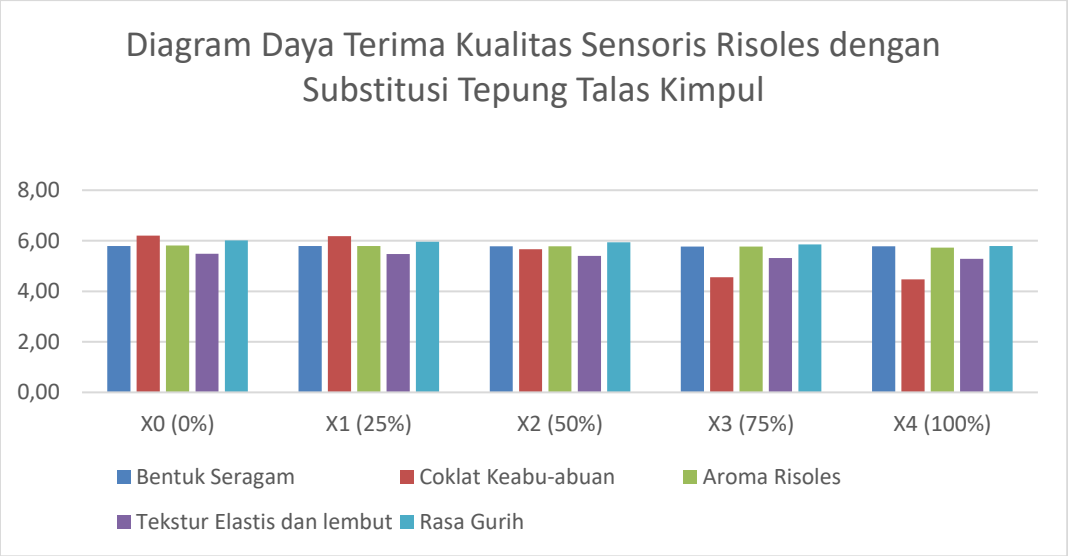
Table 7. Analysis of Variation in the Quality of Risoles Flavor Using Taro Flour as a Substitute

SK	DB	JK	KT	Fhitung	Ftabel
					0.05
Sampel	4.00	0.41	0.10	1.10	2.45
Panelis	29.00	35.59	1.23	13.14	1.57
Galat/sisa	116.00	10.83	0.09		
Total	149.00	46.83			

This indicates that substituting up to 100% taro flour does not affect the taste quality of the risoles; furthermore, the savory flavor of the risoles is more pronounced than the salty flavor. This is consistent with the findings of Windyasmara (2022), who stated that taro flour has no significant effect on the organoleptic quality of taste.

Uji Hedonik

The following table shows the final results of the hedonic test on risoles made with taro flour as a substitute, as shown in Figure 2 below.



Picture 2. Graph of Research Results on the Quality Levels of Risoles with Taro Flour Substitution

a. Preference For Shape

The results of the hedonic test showed that substituting taro flour did not reduce the panelists' acceptance of the risoles. The average scores fell into the "like" category, with X0 at 5.79, X1 at 5.79, X2 at 5.78, X3 at 5.77, and X4 at 5.78. The results of the analysis of variance (ANOVA) presented in Table 8 show that the calculated F-value is smaller than the critical F-value (0.18 < 2.45). This indicates that substituting up to 100% taro flour is not significant enough to alter the shape of the risoles; thus, the characteristic shape of the risoles remains stable and is still preferred by the panelists.

Table 8. Analysis of Variance in Preference Levels for the Texture Quality of Risoles Made with Taro Flour as a Substitute

SK	DB	JK	KT	Fhitung	Ftabel
					0.05
Sampel	4.00	0.21	0.05	0.18	2.45
Panelis	29.00	32.39	1.12	3.81	1.57
Galat/sisa	116.00	33.97	0.29		
Total	149.00	66.56			

Based on the results of the ANOVA, it can be concluded that there were no significant differences among the treatments. Therefore, the analysis was not continued with Duncan's test. This indicates that, even though taro flour was substituted at various concentrations, the panelists still gave relatively similar ratings for the shape of the risoles. Thus, substituting up to 100% taro flour did not affect the panelists' preference for the shape of the risoles.

b. Preference for Grayish Colors

The grayish color aspect in the 100% treatment was more strongly influenced by the color of the taro flour. This is indicated by the average panelist preference scores across the treatments: X0 at 6.20, X1 at 6.18, X2 at 5.67, X3 at 4.56, and X4 at 4.47. The results of the analysis of variance (ANOVA) presented in Table 9 show that the calculated F-value is greater than the critical F-value (56.31 > 2.45). These results indicate the level of panelists' preference for the color of the risoles.

Table 9. Analysis of Variance of Preference Levels for the Grayish Color Quality of Risoles Made with Taro Flour as a Substitute

SK	DB	JK	KT	Fhitung	Ftabel
					0.05
Sampel	4.00	96.11	24.03	56.31	2.45
Panelis	29.00	15.74	0.54	1.27	1.57
Galat/sisa	116.00	49.49	0.43		
Total	149.00	161.34			

Based on the ANOVA results, which indicated a significant difference, the analysis continued with Duncan's test to identify which treatments differed significantly. The results of Duncan's test in Table 10 show that each treatment differed across the groups; therefore, it can be concluded that an increase in the amount of taro flour had a significant effect on the level of preference for the grayish color of the risoles.

Table 10. Duncan's test of consumer preference for the grayish color of risoles made with taro flour as a substitute

Perlakuan	Rata-rata	LSR + rata-rata	notasi
X0 (0%)	6.20	6.50	a
X1 (25%)	6.18	6.49	a
X2 (50%)	5.67	5.99	b
X3 (75%)	4.56	4.89	c
X4 (100%)	4.47		c

This indicates that the higher the substitution level of kimpul taro flour, the grayer the color of the risoles becomes, and the lower the color quality (grayness) score of the risoles. This low color quality is due to the very gray color produced by the treatments in X3 and X4.

c. Preferred Scent

The results of the hedonic test showed that substituting taro flour did not reduce the panelists' acceptance of the aroma of the risoles. The average scores fell into the "like" category, with X0 at 5.81, X1 at 5.79, X2 at 5.78, X3 at 5.77, and X4 at 5.73. The results of the analysis of variance (ANOVA) presented in Table 11 show that the calculated F-value is smaller than the critical F-value (0.66 < 2.45). This indicates that substituting up to 100% taro flour was not sufficient to alter the aroma of the risoles; consequently, the characteristic aroma of the risoles remained dominant and was preferred by the panelists.

Tabel 11. Analysis of Variance of Preference Levels for the Aroma Quality of Risoles Made with Taro Flour Substitute

SK	DB	JK	KT	Fhitung	Ftabel
					0.05
Sampel	4.00	0.10	0.02	0.66	2.45
Panelis	29.00	28.11	0.97	25.88	1.57
Galat/sisa	116.00	4.35	0.04		
Total	149.00	32.55			

Based on the results of the ANOVA, it can be concluded that there were no significant differences among the treatments. Therefore, the analysis was not continued with Duncan's test. This indicates that, even though taro flour was substituted at various concentrations, the panelists still gave relatively similar ratings regarding their preference for the aroma of the risoles. Thus, substituting up to 100% taro flour did not affect the panelists' preference for the aroma of the risoles.

d. Preference for texture

The results of the hedonic test showed that substituting taro flour did not reduce the panelists' acceptance of the risoles' texture. The average scores fell into the "like" category: X0 was 5.49, X1 was 5.48, X2 was 5.40, X3 was 5.31, and X4 was 5.29. The results of the analysis of variance (ANOVA) presented in Table 12 show that the calculated F-value is smaller than the critical F-value (2.43 < 2.45). This indicates that substituting up to 100% taro flour is not sufficient to significantly alter the texture of the risoles.

Tabel 12. Analysis of Variance of Preference Levels for the Texture Quality of Risoles Made with Taro Flour Substitute

SK	DB	JK	KT	Fhitung	Ftabel
					0.05
Sampel	4.00	1.02	0.25	2.43	2.45
Panelis	29.00	19.93	0.69	6.54	1.57
Galat/sisa	116.00	12.18	0.11		
Total	149.00	33.13			

Based on the results of the ANOVA, it can be concluded that there were no significant differences among the treatments. Therefore, the analysis was not continued with Duncan's test. This indicates that, even though taro flour was substituted at various concentrations, the panelists still gave relatively similar ratings for the texture of the risoles. Thus, substituting up to 100% taro flour did not affect the panelists' preference for the texture of the risoles.

e. Preferred Flavors

The results of the hedonic test showed that substituting taro flour did not reduce the panelists' acceptance of the taste of the Nona Manis cake. The average scores fell into the "like" category, with X0 at 6.01, X1 at 5.96, X2 at 5.94, X3 at 5.86, and X4 at 5790. The results of the analysis of variance (ANOVA) presented in Table 13 show that the calculated F-value is smaller than the table F-value (1.92 < 2.45). This indicates that substituting up to 100% taro flour was not sufficient to alter the taste of the risoles, so the risoles retained their savory flavor and were well-liked by the panelists.

Table 13. Analysis of Variance in Preference Levels for the Taste Quality of Risoles Made with Taro Flour Substitute

SK	DB	JK	KT	Fhitung	Ftabel
					0.05
Sampel	4.00	0.93	0.23	1.92	2.45
Panelis	29.00	9.53	0.33	2.70	1.57
Galat/sisa	116.00	14.13	0.12		
Total	149.00	24.59			

Based on the results of the ANOVA, it can be concluded that there were no significant differences among the treatments. Therefore, the analysis was not continued with Duncan's test. This indicates that, even though taro flour was substituted at various concentrations, the panelists still gave relatively similar ratings for the shape of the risoles. Thus, substituting up to 100% taro flour did not affect the panelists' preference for the taste of the risoles.

Discussion (مناقشة)

This study shows that kimpul taro flour has the potential to be used as a partial substitute for wheat flour in the production of risoles. Based on the results, changes in flour composition did not have a significant effect on most of the product's sensory characteristics. The characteristics of shape, aroma, texture, and taste tended to remain consistent across various substitution levels, whereas color was the attribute most responsive to increased use of kimpul taro flour. These findings suggest that the use of kimpul taro flour in risoles production should be evaluated not only for its ability to replace wheat flour but also for its ability to maintain the desired product characteristics. Thus, regarding the research objective to determine the effect of taro flour substitution on the sensory quality and acceptance level of risoles, it can be concluded that the most noticeable effect occurs in color, while other sensory characteristics are relatively well preserved.

The results of the study indicate that substituting kimpul taro flour does not have a significant effect on the shape of the risoles. This suggests that, at the substitution levels tested,

the use of kimpul taro flour still allows the dough to produce neat and uniform risole wrappers. This is important because the risole wrappers must have a sufficiently strong structure to withstand the filling and rolling processes without tearing easily. The dough's ability to retain its shape is believed to be related to the formulation used, particularly tapioca flour, which helps provide binding strength and elastic properties to the dough. In addition to the formulation, the consistent use of processing equipment and techniques can also minimize shape variations across treatment groups. This aligns with Lawless and Heymann (2022), who explain that shape uniformity is one of the characteristics that can influence perceptions of a food product's quality and appeal. Windyasmara (2022) explains that a product's shape is influenced by the dough mixing and molding processes. Therefore, the shape stability observed in this study indicates that the substitution of kimpul taro flour is not the primary factor causing changes in the shape of the risoles when the processing is carried out under controlled conditions.

Color is the attribute most responsive to an increase in the use of kimpul taro flour. Research results show that the higher the proportion of kimpul taro flour used, the more grayish the color of the risoles' crust tends to become. This change can be attributed to the characteristics of the kimpul taro flour as a raw material as well as changes that occur during the processing. The greater the amount of kimpul taro flour used, the greater its contribution to the final color of the risoles' crust. Additionally, heating during the production and frying processes can cause color changes through non-enzymatic browning reactions. Windyasmara (2022) noted that an increase in the substitution level of taro flour results in changes in color values during heat-based processing, which may be related to non-enzymatic browning reactions—one of which is the Maillard reaction involving reducing sugars and amino groups. Therefore, the color changes observed in the risoles not only indicate statistically significant differences but also result in visual changes that can be observed by panelists and have the potential to influence perceptions of product quality.

Changes in color characteristics are significant for product acceptability because color is one of the first attributes perceived by the senses before consumers evaluate aroma, texture, and taste. The results of the study show that an increase in grayish color at higher substitution levels was accompanied by a decrease in panelists' preference for the color of the risoles. This indicates a correlation between color characteristics and product acceptability. At lower substitution levels, the color changes were not yet too dominant and were therefore still acceptable to the panelists. Conversely, at higher substitution levels, the grayish hue became increasingly noticeable, causing the product's visual appeal to decline. Thus, increasing the use of kimpul taro flour affects the appearance of risoles, making color characteristics an important aspect to consider when determining the appropriate substitution level.

In terms of aroma characteristics, the substitution of kimpul taro flour did not have a significant effect. This indicates that increasing the use of kimpul taro flour did not result in a strong enough change in aroma for panelists to distinguish between treatments. This is likely due to the use of instant kimpul taro flour, which has undergone processing and drying. These processing steps may affect the presence of volatile compounds in the ingredient, causing the characteristic taro aroma in the flour to become less pronounced. Yang et al. (2022) explain that drying methods can influence the composition of volatile compounds in taro, leading to changes in aroma and flavor characteristics after the drying process. In addition to originating from the wrapper, the aroma of risoles also results from the interaction of various ingredients used, particularly the filling and seasonings. The aromas from these ingredients can contribute to the product's overall aroma profile. Thus, the use of instant kimpul taro flour is a factor that supports its application in risoles because it does not produce an overly dominant taro aroma.

In terms of texture characteristics, increasing the substitution of kimpul taro flour also did not result in any noticeable changes. This indicates that kimpul taro flour can still be used in risoles dough without causing texture changes significant enough to be distinctly perceived by the panelists. Functionally, kimpul taro flour contains starch that can undergo gelatinization when subjected to heat treatment. The gelatinization process and gel formation can play a role in determining the structure and texture of food products. Calle et al. (2021) explain that kimpul flour possesses functional starch properties that contribute to the gelatinization process and gel formation. Furthermore, the inclusion of tapioca flour in the formulation can also help maintain the dough's characteristics. Therefore, the texture stability observed in this study indicates that the use of kimpul taro flour does not directly result in a decline in texture quality. The final product characteristics are influenced by the interaction between the types of flour, additives, and the processing methods employed.

In terms of flavor characteristics, substituting kimpul taro flour had no significant effect on the flavor of the risoles. This indicates that increasing the proportion of kimpul taro flour did not significantly alter the product's overall flavor profile. The taste of risoles is influenced not only by the wrapper but also by the filling and seasonings used. The ragout filling—composed of chicken, carrots, potatoes, milk, salt, and pepper—contributes to the product's overall taste. The savory flavor components derived from the filling and seasonings are presumed to be more dominant than the flavor contribution of kimpul taro flour in the risole wrapper. These findings align with those of Windyasmara (2022), who stated that the use of taro flour does not have a significant effect on the organoleptic quality of taste. Thus, changes in the flour composition of the wrapper do not always result in a noticeable change in taste if the flavor characteristics of the filling and seasonings remain dominant.

The acceptability test results provide insight into the panelists' acceptance of the changes in sensory characteristics resulting from the substitution of kimpul taro flour. In general, changes in flour composition did not directly lead to a decrease in the acceptability of the risoles' appearance, aroma, texture, and taste. This indicates that sensory quality and acceptability are two interrelated aspects, but they are not entirely synonymous. A change in a sensory attribute does not necessarily mean that the product will be disliked by panelists. In this study, the most noticeable relationship was found in the color attribute. An increase in the intensity of the grayish color tended to be followed by a decrease in the panelists' liking for the color of the risoles. Thus, color is a more decisive attribute for acceptability than aroma, texture, or taste when using kimpul taro flour in risoles.

The results of the study indicate that kimpul taro flour has the potential to be used as a substitute for wheat flour in the production of risoles, as the characteristics of shape, aroma, texture, and taste can still be maintained. However, increasing the proportion of kimpul taro flour causes the most noticeable change in color characteristics, which in turn affects the panelists' preference ratings for that attribute. Thus, a key finding of this study is not only that kimpul taro flour can be utilized in risoles production but also that color is identified as a primary aspect that must be considered in product development. The results of this study can serve as a basis for developing risoles made with kimpul taro flour while still taking into account visual characteristics and consumer acceptance. With proper control of the substitution level and appropriate product characteristics, the use of kimpul taro flour as a local food ingredient can continue to be developed to support food diversification without compromising product quality.

Conclusion (خاتمة)

Based on the research results, a 25% substitution rate can still maintain the sensory quality of taro flour-substituted risoles. However, as the taro flour substitution rate increases, the color of the resulting risoles tends to become more grayish. This is because taro flour contains phenolic compounds that can produce a brownish color. Furthermore, the process of processing taro into flour can cause color changes; the higher the proportion of taro flour used, the more noticeable the color change in the risoles becomes.

Hedonic test results indicate that as the substitution level of taro flour increases, panelists' acceptance of the risoles' color tends to decrease. The best results were obtained with a 25% taro flour substitution, as it yielded the highest level of preference for color, categorized as "not grayish." Thus, taro flour has the potential to be used as a substitute in food products, reducing the use of wheat flour and adding value to the product without diminishing the panelists' acceptance of the product's overall quality.

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