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Organoleptic Test of Chicken Sausage Made from Mocaf with The Addition of Moringa Leaves (*Moringa oleifera*)

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ABSTRACT
This study aims to analyze the effect of adding moringa leaf extract (Moringa oleifera) on the organoleptic characteristics of chicken sausages based on mocaf flour (Modified Cassava Flour). The research design used was a Completely Randomized Design (CRD) with three treatments: the addition of 5 gr (P1), 10 gr (P2), and 15 gr (P3) of moringa leaf extract, each with three replications. The research method used in this study was descriptive qualitative which was continued with ANOVA test and 5% BNT test. The results showed that treatment P2 (10 gr) produced the highest score on all organoleptic parameters. The color of the sausage looks more attractive, the aroma is fresher, the most preferred taste, and the texture is chewy and soft. Meanwhile, P3 produces a color that is too thick and the aroma tends to be unpleasant so it is less preferred. P1 showed quite good results but not optimal. Based on these results, the addition of 10 gr of moringa leaf extract is the best formulation to improve the sensory quality of mocaf chicken sausages and has the potential as an innovation in functional food products accepted by consumers.

***Keywords**: moringa leaves, mocaf, chicken sausage, organoleptic.*

INTRODUCTION

The food industry continues to develop with a focus on product innovation that is not only delicious, but also has high nutritional value and functionality. One of the processed products that is widely favored by the public is chicken sausage, because it is practical, has a delicious taste, and is high in protein (Lawrie, 2003). However, the development of chicken sausages from healthier alternative raw materials is still needed, especially to meet the needs of consumers who are conscious of nutrition.

Mocaf flour (Modified Cassava Flour) is a fermented cassava-based flour, is gluten-free, and has a high carbohydrate content and good dietary fiber (Yuwono et al., 2013; Dwi Fibrita, 2019). Mocaf has been widely used as a substitute for wheat flour in the functional food industry.

Moringa leaves (Moringa oleifera) are known as plants that are rich in nutrients, containing protein, vitamins A, C, E, and minerals such as calcium and iron in high amounts (Gopalakrishnan et al., 2016; Anwar et al., 2007). In addition, moringa leaves contain bioactive compounds such as flavonoids and polyphenols that function as natural antioxidants. The potential of moringa as a fortification material in food products has been widely studied because of its ability to increase nutritional value without disrupting sensory characteristics if used in the right doses.

The use of natural ingredients such as mocaf and moringa leaf extract in making chicken sausages is a form of innovation that not only enriches nutritional value, but also pays attention to organoleptic qualities such as taste, color, aroma, and texture. According to Gopalakrishnan et al. (2016), the use of moringa leaves in processed products can provide natural color and distinctive taste characteristics if formulated properly. Furthermore, consumer awareness regarding healthy and functional food choices has driven researchers and food technologists to continuously explore alternative ingredients that not only improve product quality but also contribute to better health outcomes. In this context, the

combination of mocaf and moringa leaf extract in processed meat products such as chicken sausages is considered a strategic approach to meet both nutritional and sensory expectations.

This study was conducted to analyze the addition of moringa leaves (Moringa oleifera) to the organoleptic of chicken sausages using mocaf flour (Modified Cassava Flour). This study aims to evaluate the extent to which the addition of moringa leaves in chicken sausage formulations can affect sensory aspects, including color, aroma, taste, and texture of the product. The results of this study are expected to provide useful scientific information as a reference in the development of mocaf-based food products with the addition of natural functional ingredients such as moringa leaves, in order to create alternative products that not only have high nutritional value, but are also well received sensorially by consumers.

METHOD

This research was conducted from December 2024 to March 2025 in Badas Village, Sumobito District, Jombang Regency. The method used was an experiment with a one-factor Completely Randomized Design (*CRD*), namely the concentration of moringa leaf extract at three levels: P1 (5 g), P2 (10 g), and P3 (15 g), each with three replications. The materials used were Mocaf flour (500gr), tapioca flour (250gr), chicken meat (100gr), salt (½ tbsp), garlic (3 cloves), eggs (2 eggs), powdered broth (½ tbsp), pepper powder (½ tbsp), Saori oyster sauce (23 ml), and water (800 ml). The tools used were a large bowl or basin, knife, pan, stove, digital scale, 80 mesh sieve, plastic popsicles, small funnel, mixer, coper and scissors.

Table 1. Concentration of Moringa Leaf Extract

Treatment		
P1	P2	P3
5 gr	10 gr	15 gr

The stages in making chicken sausage include grinding chicken meat, making moringa leaf extract using the drying and pounding method, making sausage dough, filling sausage dough into casings, boiling and steaming, chicken sausage with the addition of moringa leaves, data analysis and research results. The chicken meat is ground until smooth to make it easier to mix with other ingredients. Furthermore, the harvested moringa leaves (*Moringa oleifera*) are dried using the natural drying method, then finely ground into powder or extracted so that they are easy to mix into the dough. The moringa leaves that have become extracts are added to the sausage dough which also contains mocaf flour (*Modified Cassava Flour*), spices, and other binders. The mixing process is carried out until homogeneous, producing sausage dough that is ready to be molded.

The sausage dough is then inserted into the casing using a filler, then the boiling process is carried out for several minutes to strengthen the product structure. After that, the sausages are steamed so that the texture becomes softer and evenly cooked. The addition of moringa leaf extract to this sausage aims not only as a nutritional enhancer, but also to improve organoleptic characteristics such as color and taste. This method refers to the procedure for making chicken sausages as described by Pratiwi et al. (2018) and is determined according to the quality standards for processed chicken meat products according to the National Standardization Agency (BSN, 2015), with adjustments to the addition of functional natural ingredients such as moringa leaves (Gopalakrishnan et al., 2016) and mocaf as a substitute for gluten (Mas'udah, 2020).

Organoleptic tests were carried out using a hedonic test by 15 semi-trained panelists, using a scale of 1 to 5, where 1 = very dislike, and 5 = very like. The assessment was carried out individually and the results were collected using a closed questionnaire sheet. Data collection methods include: Direct observation of chicken sausage processing, Hedonic questionnaire, according to the method by Kurniawan (2021), Documentation, namely recording the production process and test result data.

The data was analyzed qualitatively descriptively and continued with the ANOVA (Analysis of Variance) statistical test to see the effect of treatment on each organoleptic parameter. If there is a significant difference, it is continued with a further BNT 5% test. This method is used to determine the best formulation in the use of moringa leaf extract on the sensory quality of mocaf flour-based chicken sausage.

RESULT AND DISCUSSION

This study aims to examine the effect of adding moringa leaves (Moringa oleifera) on the

organoleptic properties of chicken sausage. The product was divided into three treatments (P1, P2, and P3) based on variations in moringa leaf concentration. The test results are presented in tables and graphs to make them easier to understand.

Result

Organoleptic Test

This study evaluated the addition of moringa leaves to the organoleptic of chicken sausages made from mocaf flour through three different treatments. Organoleptic tests were conducted on four attributes, namely color, aroma, taste, and texture, involving 15 semi-trained panelists using a hedonic scale. Each treatment was given a variation in the amount of moringa leaves added of 5 grams, 10 grams, and 15 grams per 500 grams of mocaf flour. The results of the analysis showed that the treatment with the addition of 10 grams of moringa leaves (treatment P2) produced the highest average value for all organoleptic parameters, with a color score of 6.60, aroma 5.40, taste 5.40, and texture 5.45. Treatment P2 produced a rather dark green color, a distinctive aroma that was not too strong, and the taste that was most preferred by panelists. The addition of moringa leaves not only affected the color and taste, but also increased the visual appeal of the sausage. In addition, moringa leaves contributed to increasing nutritional value due to the content of antioxidants and other active substances.

Figure 1. Chicken sausage

ANOVA TEST

Data analysis in this study was conducted using the ANOVA table which functions to identify significant differences between the means of several treatment groups. This procedure includes statistical data processing to evaluate the effect of treatment on the observed variables.

1. Colour

   The results of the organoleptic test values on chicken sausages using the analysis of variance (ANOVA) method showed differences in color assessment between the three treatments. The average values obtained from the organoleptic color test of chicken sausages are shown below.

Table 2. Average values of chicken sausage colour

No	Treatment	Colour
1	P1	4.90
2	P2	6.50
3	P3	2.64
BNT 5%		1.75

Source: Data processed 2024

Based on the ANOVA test results above, there were significant differences in the color attributes of chicken sausages between treatments. Further testing using the Least Significant Difference (LSD) method at the 5% level showed that treatment P2 (6.50) and treatment P1 (4.90) were not significantly different, while treatment P3 (2.64) was significantly different from both. Thus, treatment P2 produced the chicken sausage color most favored by the panelists.

2. Aroma

   The results of the organoleptic test on chicken sausages using the analysis of variance (ANOVA) method showed differences in aroma assessment between the three treatments. The average values obtained from the organoleptic aroma test of chicken sausages are shown below.

Table 3. Average value of chicken sausage aroma

No	Treatment	Aroma
1	P1	3.10
2	P2	5.40
3	P3	2.76
BNT 5%		2.65

Source: Data processed 2024

Based on the results of the analysis of variance (ANOVA) above, it was found that there were significant differences in aroma parameters between treatments. Further testing using the 5% LSD method showed that treatment P2 (5.40) was significantly different compared to treatments P1 (3.10) and P3 (2.76). Thus, treatment P2 provided a less unpleasant aroma that was significantly preferred by the panelists.

3. Taste

The results of the organoleptic test on chicken sausages using the analysis of variance (ANOVA) method showed differences in taste between the three treatments. The average values obtained from the organoleptic aroma test of chicken sausages are shown below.

Table 4. Average taste rating of chicken sausage

No	Treatment	Taste
1	P1	4.26
2	P2	5.40
3	P3	3.97
BNT 5%		1.03

Source: Data processed 2024

Based on the results of the analysis of variance (ANOVA), it was found that there were significant differences in the taste attributes of chicken sausages between the three treatments. The results of further tests using the Least Significant Difference (LSD) at a significance level of 5% showed that treatment P2 (taste score 5.40) was significantly different from treatments P1 (4.26) and P3 (3.97), but treatments P1 and P3 were not significantly different from each other. This indicates that treatment P2 provided the best contribution to improving the taste quality of the resulting chicken sausage product.

4. Texture

The results of the organoleptic test of chicken sausage using the analysis of variance (ANOVA) method showed differences in aroma assessment between the three treatments. The average values obtained from the organoleptic texture test of chicken sausage are shown below.

Table 5. Average Texture Values for Chicken Sausage

No	Treatment	Texture
1	P1	4.99a
2	P2	5.45a
3	P3	3.78b
BNT 5%		1.9541

Source: Data processed 2024

Based on the results of the organoleptic test on the texture of chicken sausage, the highest average value was obtained in treatment P2 at 5.45, indicating a significant difference compared to the other treatments. Treatment P1 obtained a score of 4.99, which means it was not significantly different from treatment P2, but significantly different from treatment P3. Meanwhile, treatment P3 showed the lowest score of 3.78, which means it was significantly different from the other treatments.

5. Best Treatment

In the chicken sausages tested, there were three treatments, each assessed based on organoleptic categories. The best treatment was determined based on the average organoleptic score, with the treatment with the highest quality compared to the other treatments selected as the best. The best treatment average organoleptic score for each treatment can be seen below.

Table 6. Best treatment average organoleptic test for chicken sausage

Treatment	Average Organoleptic Test			
	Colour	Taste	Aroma	Texture
P1	4.90	4.26	3.10	4.99
P2	6.50	5.40	5.40	5.45
P3	5.64	3.97	2.76	3.78

Source: Data processed 2024

Based on the comparison results in the table above, the best treatment for chicken sausage is treatment P2, where the concentration of moringa leaf extract is 10 grams with a boiling and steaming time of 15 minutes at a temperature of 72 ° C. Treatment P2 shows superior organoleptic quality compared to other treatments in terms of color, taste, aroma and texture. Therefore, chicken sausages produced from treatment P2 show superior quality and are more in demand, according to the preferences expressed by panelists in the organoleptic test.

Discussion

This study focuses on the organoleptic test results of mocaf flour-based chicken sausage with the addition of moringa leaf extract, including color, flavor, aroma, and texture. Each parameter was analyzed based on panelist responses to the three treatments (P1, P2, and P3) used to evaluate consumer preferences and the effect of formulation on the product's sensory quality. The following is a detailed discussion of each aspect:

1. Colour

   Color is an important indicator in organoleptic testing because it influences consumer perception of product quality. According to Lawless & Heymann (2010), color not only serves as a quality indicator but can also influence consumer expectations regarding a product's taste and aroma. Therefore, assessing color in organoleptic testing is crucial for understanding how consumers respond to a product overall.

   In this study, treatment P2 produced the most attractive chicken sausage color, while P1 and P3 were less visually appealing. According to (Sari & Hidayati, 2020), the resulting green color comes from the chlorophyll and carotenoid pigments in moringa leaves and non-enzymatic reactions during processing. The mixture of mocaf flour and moringa leaf extract produces chicken sausages with varying colors, namely pale green, medium green, and dark green.

   The most preferred color by the panelists was medium green, while the least preferred color was dark green. The green color of chicken sausages using mocaf flour and moringa leaf extract was influenced by the concentration of moringa leaves added. The higher the concentration of moringa leaves, the more intense the green color produced, due to the pigment content in moringa leaves. This study shows that the addition of moringa leaf extract can increase the color level of chicken sausages, with this it is necessary to match the right concentration of moringa leaf extract to get the visual appearance of the sausage that is preferred by the panelists.

2. Aroma

   Aroma influences consumer perceptions and decisions regarding food products. According to Lawless and Heymann (2010), aroma consists of volatile compounds that can influence taste perception and consumer appeal to a product. This is in line with (Stone & Sidel, 2004), who stated that aroma assessments are conducted by trained panelists using sensory evaluation

methods to measure aroma intensity and complexity, which can contribute to consumer decisions when choosing a product.

In this study, chicken sausages showed a level of aroma. In treatments P1 and P2, the aroma of chicken sausage was not unpleasant, while in P3 the chicken sausage tasted very unpleasant. This is in line with research (Nugroho, 2013), that this is because the greater the amount of added moringa leaf powder, the more intense/sharp the characteristic unpleasant aroma of moringa. The characteristic unpleasant aroma of moringa is produced by the lipoxidase enzyme hydrolyzing or breaking down fat into compounds that cause unpleasant odors.

In treatment P3, the concentration of moringa leaf extract was very high, resulting in an unpleasant aroma, resulting in a sharp, unpleasant odor even after boiling and steaming. This study suggests that the concentration of moringa leaf extract needs to be considered, as the higher the dose, the more intense the unpleasant aroma, which can influence panelist preferences

3. Taste

Taste is an essential factor in evaluating food quality (Buntaran et al., 2009). In the taste test on chicken sausage, the treatments with the highest scores were P2 & P1, namely 5.40 & 4.26, which means "very tasty" compared to treatment P3 with a score of 3.97, which means "not tasty". Treatment P1 was not significantly different from treatment P2 compared to treatment P3. This shows that the panelists preferred chicken sausages from treatments P2 and P1. The resulting taste is more savory and yummy with a blend of authentic flavors of moringa leaves, although the panelists indicated a level of familiarity that sausages are usually made with wheat flour.

Ayu (2015) stated that the concentration of moringa leaf extract needs to be considered because the higher the addition of moringa leaf powder to sausages, the more bitter the resulting taste. Moringa leaves have a distinctive taste due to the tannin content in them. Syarifah (2015) stated that the higher the addition of moringa leaf powder to a food ingredient, the more bitter the taste will be, and the resulting green color will make a clear difference.

4. Texture

Product texture in organoleptic testing refers to physical properties that can be perceived by the sense of touch, which includes characteristics such as chewiness, roughness, and softness. Texture assessment is very important because it can influence consumer experience and purchasing decisions. According to Ameer, K., & Kaur, S. (2019), organoleptic testing often involves panelists who provide subjective assessments of product texture, so that the results can be used to improve product quality and appeal.

In this study, treatment P2 received the highest score, namely 5.45, while treatment P3 received a score of 3.78. The results of the assessment of the level of preference for sausage texture above indicate that panelists preferred treatments P2 and P1 compared to treatment P3. This is because the treatment carried out on chicken sausages on texture experienced a difference that was not too much. This indicates that the addition of different concentrations of Moringa leaf extract resulted in a texture that was not too different. This is in line with the results of research (Dedi, 2012), stating that there are differences in sausage texture due to unequal concentrations.

CONCLUSIONS

This study shows that the addition of Moringa oleifera leaf extract at various concentrations significantly affects the organoleptic quality of mocaf flour-based chicken sausages. Treatment P2 (10 gr) produces a rather dark green color and is visually attractive compared to other treatments. In terms of aroma, Treatment P1 (5 gr) obtained the highest score because it produces a fresh but not pungent Moringa leaf aroma, while P3 (15 gr) tends to produce a rancid aroma. In terms of taste parameters, P2 and P1 displayed a taste that was preferred by panelists compared to P3. Overall, Treatment P2 obtained the highest score in all organoleptic parameters due to a good balance between color, aroma, and taste. Therefore, a concentration of 10 gr Moringa leaf extract (P2) is considered the most optimal formulation in producing chicken sausages with the best organoleptic quality according to consumer preferences.

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