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# The Addition of Moringa Leaf Composite Flour and Chicken Liver Improves the Quality Characteristics, Fe Content, and Antioxidant Capacity of Siomai

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**ABSTRACT**

**Background:** Siomai is a minced meat product wrapped in a thin skin made from wheat flour and cooked through a steaming process. In this study, there was the addition of composite flour of moringa leaves and chicken liver. This study aims to determine the effect of the addition of moringa leaves and chicken liver composite flour on organoleptic quality, iron (Fe) content, and antioxidant capacity in dumplings. This type of research is experimental with a randomized block design (RBD). **Methods**: The treatment given was 5 types of treatment with 3 repetitions. Data analysis used aims to determine the effect of treatment on organoleptic quality, levels of iron (Fe), and antioxidant capacity using analysis of variance (ANOVA). **Results**: The results showed that there was an influence on organoleptic quality including aroma quality, taste quality, texture quality, overall acceptability, iron (Fe) content, and antioxidant capacity in dumplings. The addition of moringa leaf and chicken liver composite flour as much as 16% per weight of ground chicken meat resulted in the most widely accepted quality with characteristics of a non-pleasant aroma, savory taste, chewy texture, overall acceptance of likes, iron (Fe) content of 2.23 mg/ 100 g and antioxidant capacity of 0.0107%.

**Keywords**: Siomai, Composite Flour, Moringa Leaves, Chicken Liver, Iron, Antioxidant Capacity

## INTRODUCTION

Siomai is a snack that is a food product that is well known to many foreign audiences with its delicious taste, served in dumpling skins with various fillings and prepared by steaming. Siomay which uses chicken as the basic ingredient can be modified by adding natural foods to increase nutrition, both macro and micronutrients. Like adding Moringa leaf flour and chicken liver mixed through a sieving process. Moringa leaves have benefits for human life such as medicine, food sources, and cosmetic and beauty products. Consuming vegetables, especially Moringa leaves, is useful for preventing anemia in teenagers because they contain high levels of iron. Apart from that, Moringa leaves contain high levels of antioxidants. As is known, according to Riskesdas in 2018, the prevalence of anemia in teenagers in Denpasar City was 45.9%. In addition, the high iron content in chicken liver can prevent and improve nutritional problems, especially iron deficiency anemia in young women. According to Lutfiah et al. (2021), the modification of chicken liver in sausage products has a significant effect on iron levels, namely 7.41 grams with the addition of 55 grams of chicken liver5. Therefore, researchers are interested in studying how large the proportion of adding composite flour from Moringa leaves and chicken liver to siomai dough is acceptable in terms of organoleptic and nutritional value as a snack as an alternative to prevent anemia in young women.

This research aims to determine the effect of adding composite flour from Moringa leaves and chicken liver on the quality characteristics of siomai. The specific objectives of this research are to carry out organoleptic tests which include color, aroma, taste, texture, and overall acceptability of Moringa leaf and chicken liver composite flour siomai, analyze the quality of taste, aroma and texture of Moringa leaf and chicken liver composite flour siomai, analyze Iron content and antioxidant capacity of Moringa leaf and chicken liver composite flour siomai determine the best treatment for Moringa leaf and chicken liver composite flour siomai.

## METHOD

This type of research uses an experimental method with a Randomized Block Design which was carried out with 5 types of treatment and each had 3 replications so that there were a total of 15 units. This research was carried out at the Food Processing Laboratory, Nutrition Department, Health Polytechnic, Ministry of Health, Denpasar, while tests for iron levels and antioxidant capacity were carried out at the Analytical Laboratory at Udayana University, Jimbaran.

The tools for making dumplings are basins, trays, blenders, and 100 mesh sieves, frying pans, wooden stiles, spectrophotometers, atomic absorption (SSA), electric baths, analytical balances, ovens, electric furnaces, excipients, measuring flasks (size 25 ml, 50 ml, and 100 ml), 300 ml Erlenmeyer, 25 ml volume pipette, 5 ml and 10 ml scale pipette, knife, evaporator cup, funnel, dropper pipette, stirrer rod, substance spoon, container bottle. Meanwhile, the ingredients used are Moringa leaves, chicken liver, ground chicken meat, fresh chicken egg whites, sugar, salt, fresh skinned shallots and garlic, fresh spring onions, odorless sesame oil, golden yellow, dumpling skin, distilled water, concentrated HNO3, 1000 ppm iron stock solution, Whatman No.41 filter paper.

The process of making Moringa leaf flour and chicken liver is that first the Moringa leaves are blanched then dried in the oven and the chicken livers are boiled with spices and then dried in the oven. After the two flours are dry, they are ground and sifted. To get composite flour, the two flours are mixed in a 1:1 ratio (250 grams of moringa flour: 250 grams of chicken liver flour) and then sifted together. The following is the formulation for making dumplings from composite flour of Moringa leaves and chicken liver. Data analysis used the ANOVA test.

**Table 1.** Formulation of Composite Flour Siomay from Moringa Leaves and Chicken Liver

| material | Treatment (gram) | | | | |
|---|---|---|---|---|---|
| | P 1 | P 2 | P 3 | P 4 | P 5 |
| Composite Flour (g) | 4 | 8 | 12 | 16 | 20 |
| | 50 | 50 | 50 | 50 | 50 |
| Chicken meat (g) | 5 | 5 | 5 | 5 | 5 |
| Tapioca flour (g) | 10 | 10 | 10 | 10 | 10 |
| Egg white (g) | 3 | 3 | 3 | 3 | 3 |
| Salt (g) | 2 | 2 | 2 | 2 | 2 |
| Sugar (g) | 2 | 2 | 2 | 2 | 2 |
| B. red (g) | 10 | 10 | 10 | 10 | 10 |
| B. white (g) | 2 | 2 | 2 | 2 | 2 |
| Spring onions (g) | 2 | 2 | 2 | 2 | 2 |
| Sesame oil (g) | 2 | 2 | 2 | 2 | 2 |
| Dumpling skin | | | | | |

Product characteristics can be seen through organoleptic tests and chemical levels of the product. Organoleptic tests were carried out using hedonic and hedonic quality tests with 30 untrained panelists. Hedonic assessments include aroma, texture, taste, color, and overall. Meanwhile, hedonic quality includes color quality, aroma quality, and taste quality with an assessment scale of 1 - 5. Chemical content assessment includes iron (Fe) content and antioxidant capacity.

**RESULTS**

A. Subjective Characteristics

**Table 2**. Average Hedonic Test of Moringa and Chicken Liver Siomay

| Treatment | Average Hedonic Test Value | | | | |
|---|---|---|---|---|---|
| | Texture | Taste | Colour | Aroma | Overal |
| **P1** | 3,60a | 4,50a | 3,99a | 4,12a | 4,13a |
| **P2** | 3,73a | 4,02a | 4.40a | 4,50a | 4,55a |
| **P3** | 3,33b | 3,45b | 3,77a | 3,94a | 3,62a |
| **P4** | 3,27b | 3,43c | 3,41b | 3,33b | 3,26b |
| **P5** | 2,96c | 3,23c | 3,28c | 3,11b | 3,21c |

Note: Different letters behind the average indicate a very significant difference based on the BNT test at the 1% level (P<0.01).

The color produced from the composite flour siomai product of Moringa leaves and chicken livers shows a light green to dark green color from each additional concentration of Moringa flour and chicken livers. The highest organoleptic test value for the siomai color of Moringa leaf and chicken liver composite flour was the highest for P2 siomai, namely 4.40 (liked), and the lowest for P5 siomai, namely 3.29 (neutral). So it can be interpreted that the color of the siomai will be less favorable when more flour concentration is added.

The aroma of the siomai flour composite of Moringa leaves and chicken liver shows a pleasant aroma from each additional concentration of Moringa flour and chicken liver. The highest organoleptic test value was for P2 siomai, namely 4.50 (liked) and the lowest was for P5 siomai, namely 3.11 (neutral). So the aroma of siomai will be less favorable when more flour concentration is added.

The texture of the siomai composite of Moringa leaf flour and chicken liver was the highest in P2 siomai, namely 3.73 (like), and the lowest in P5 siomai, namely 2.96 (neutral). So it can be interpreted that the texture of the siomai will be less favorable when more flour concentration is added.

The siomai taste of composite flour from Moringa leaves and chicken liver produces a savory taste from each additional concentration of Moringa flour and chicken liver. The highest organoleptic test value was found in P1 siomai, namely 4.50 (like) and the lowest was in P5 siomai, which was 3.23 (neutral). So it can be interpreted that the taste of dumplings will be less favorable when more flour concentration is added.

The highest organoleptic assessment for the overall acceptance of Moringa leaf and chicken liver composite flour siomai was highest for P2 siomai, namely 4.55 (like) and low for P5 siomai, namely 3.21 (neutral). So it can be interpreted that the higher the concentration of Moringa leaves and chicken liver, the less good the overall acceptance value.

B. Objective Characteristics

**Table 3.** Average Objective Quality of Shumai Moringa Leaf Flour and Chicken Liver

| | Average Laboratory Test Values | |
|---|---|---|
| | Iron (Fe) (mg/100 gram) | Antioxidant Capacity (%) |
| **P1** | 1,90c | 0,0067a |
| **P2** | 2,23c | 0,0107a |
| **P3** | 2,31b | 0,0133a |
| **P4** | 3,06a | 0,0164a |
| **P5** | 4,77a | 0,0192a |

Note: Different letters behind the average indicate a very significant difference based on the BNT test at the 1% level (P<0.01)

The iron (Fe) value of moringa leaf siomai flour and chicken liver with different concentrations of each treatment can be seen in the picture. The iron (Fe) test results showed that the highest iron (Fe) content was in P5, namely 4.77 mg/100 g, while the lowest iron (Fe) content was in P1, namely 1.90 mg/100 g.

The average value of the antioxidant capacity of moringa leaf flour siomai and chicken liver given different concentrations of each treatment can be seen in the picture. The results of the antioxidant capacity test showed that the highest antioxidant capacity was found in P5, namely 0.01920%, while the lowest antioxidant capacity was found in P1, namely 0.00670%.

**DISCUSSION**

The highest organoleptic test value for the siomai color of Moringa leaf and chicken liver composite flour was the highest for P2 siomai, namely 4.40 (liked), and the lowest for P5 siomai, namely 3.29 (neutral). So it can be interpreted that the color of the siomai will be less favorable when more flour concentration is added. This research is supported by research by Marta (2019) which states that there are significant differences in the characteristics of the buns with the addition of Moringa leaf extract on the color quality of the buns, which causes the color to become dark green and is less liked by panelists4. Meanwhile, according to Malichati AR (2018), the higher the addition of chicken liver flour to the chicken stock, the darker the color of the instant chicken stock6.

Based on the average preference test for the aroma of siomai with the addition of Moringa leaf flour and chicken liver, the highest was in the second treatment, namely the addition of composite flour of Moringa leaves and chicken liver of 16% per weight of ground chicken meat with a score of 4.50 (like). Based on the average hedonic quality test for the aroma of siomai and chicken liver with Moringa leaf flour, the highest score was obtained in the second treatment with the addition of Moringa leaf and chicken liver composite flour at 16% per weight of ground chicken meat with a score of 2.89 (unpleasant). This is in line with research by Malichati AR (2018) which states that the stronger intensity of the typical aroma of roasted chicken is actually less preferred because the formula with the addition of 40% chicken liver flour is accompanied by an increase in the fishy aroma typical of chicken liver (Malichati, 2018).

Based on the average hedonic taste test, the highest score was obtained for the addition of composite flour of Moringa leaves and chicken liver at 8% with a score of 4.52 (like). Meanwhile, the average hedonic quality of taste obtained the highest score from the addition of composite flour of Moringa leaves and chicken liver at 8% with a score of 2.90 (savory). This is in line with research by Oktavia Cahyaningati, et al. (2020) which stated that the addition of 2.5% moringa flour was preferred by panelists compared to the addition of 7.5% moringa flour.

Based on the average hedonic test on siomai texture with the addition of composite flour of Moringa leaves and chicken liver, the highest value or score was an addition of 16% per weight of chicken meat. Meanwhile, based on the average hedonic quality value of the siomai texture, Moringa leaf flour and chicken liver obtained the highest value in the second treatment with the addition of composite flour of 16%. This is in accordance with research conducted by Oktavia Cahyaningati, et al. (2020) which stated that there was an effect of adding Moringa leaf flour with an addition of 2.5% which panelists preferred on the texture of catfish meatballs (P<0.05)1. This is also in line with research where the average panelist's highest level of preference for donuts with the addition of chicken liver flour was 10 grams compared to the addition of 15 grams and 20 grams of chicken liver flour.

The panelists' overall preference for composite flour siomai from Moringa leaves and chicken liver was treatment 2, namely the addition of 16% composite flour per weight of ground chicken meat, which was indicated by a hedonic score of 4.55 (liked) because, in terms of savory taste, the aroma was not unpleasant. and chewy texture.

The average analysis of the iron content of siomai flour composite of moringa leaves and chicken liver ranged from 1.90 – 4.77 mg/100 g. The iron (Fe) test results showed the lowest iron content in the first treatment (P1), namely 1.90 mg/100 g, and the highest iron content in the fifth treatment (P5), namely 4.77 mg/100 grams. This is in line with research by Elok Anisa Rahmayanti, (2020) which stated that there was an increase in iron levels in sausages influenced by the high iron content in Moringa leaf flour so that adding more Moringa flour by 18.11% could increase iron levels by 9.4 mg/100 g in sausages. Meanwhile, according to (Malichati AR, 2018) there is an effect of adding 10% chicken liver flour on the iron content in commercial instant chicken broth products, namely 2.04 mg6. The high iron (Fe) content in food can be used as an alternative to treat anemia. In treating anemia, iron is essential, because iron deficiency can increase the risk of developing anemia up to 276 times greater.

Based on the average antioxidant capacity in siomai with composite flour of Moringa leaves and chicken liver, it ranges from 0.0067 – 0.0192%, the best antioxidant capacity in siomai with composite flour of Moringa leaves and chicken liver is found in layer five (40% composite flour) which shows that the antioxidant capacity is 0.0192%. This high level of antioxidant is influenced by the concentration of composite flour which increases from treatment 1 to 5, this is in line with research by Ellya (2022) which states that the higher the concentration of moringa flour is added, the higher the antioxidant can be a radical inhibitor. Moringa leaves contain bioactive antioxidants such as tannins, steroids, triterpenoids, flavonoids, phenolics, saponins, and alkaloids (Nanak Antarini, 2013).

**CONCLUSION(S)**

Based on the results obtained, it was concluded that the organoleptic results of the Moringa leaf and chicken liver composite flour siomai produced were an average color preference of 3.29 – 4.40 (neutral – liked), aroma 3.11 – 4.50 (neutral – like), texture 2.97 – 3.73 (neutral – like), taste 3.23 – 4.52 (neutral – like), overall acceptability 3.21 – 4.56 (like). The organoleptic quality results of the Moringa leaf and chicken liver composite flour siomai produced were aroma quality 2.43 – 2.89 (somewhat unpleasant – not unpleasant), texture quality 2.00 – 2.74 (slightly chewy – chewy) and taste quality 2. .20 – 2.90 (slightly savory – savory). The test results for iron (Fe) levels were 1.90 – 4.77 mg/100 g, and antioxidant capacity was 0.0067 – 0.0192%. Siomay whose quality is acceptable in terms of characteristics is with the addition of composite flour of Moringa leaves and chicken liver as much as 16% per weight of ground chicken meat with the quality characteristics of not unpleasant aroma, chewy texture quality, savory taste quality and overall acceptance is favorable.

**Conflict of Interest**

All research teams stated that there was no conflict of interest in this research

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