The effect of marination using sweet basil (*Ocimum basilicum*) spices on the physical quality of local chicken meat

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Abstract. Sweet basil (*Ocimum basilicum*) is a popular herb for flavouring and has a fresh taste. Besides being used for spices, sweet basil is also commonly used as medicine because it has nutritional content. The purpose of this study was to determine the effect of marination using sweet basil (*Ocimum basilicum*) at different concentrations on the physical quality of local chicken meat. This study used a completely randomized design with 4 treatments and 5 replications. This study had several treatments based on the concentration of sweet basil, namely P0: 0%, P1: 3%, P2: 6%, and P3: 9% with a marinating time of 30 minutes. After marinating, meat was stored at room temperature for 24 hours and then physical quality measurements were taken. The results of the study showed that marination with sweet basil had a significant influence (P<0.05) on the physical quality of local chicken meat. Sweet basil can reduce the pH value, maintain water content, reduce the percentage of cooking loss, reduce the percentage of drip loss, and increase meat tenderness. It can be concluded that 6% sweet basil marinade (*Ocimum basilicum*) can produce the best physical quality of local chicken meat.

1. Introduction
Sweet basil (*Ocimum basilicum*) is a popular spice to enhance the taste of cuisine. Aside from being an herb, sweet basil is also used as a medicine because it is beneficial for health and has good nutritional content. Sweet basil has a refreshing aroma and a hint of sweetness. In Indonesia, sweet basil is known by the name "the basil" which is of a different type from lemon basil. According to [1], the nutrient content of sweet basil leaves is vitamin A, vitamin C, 4.2 grams of protein, 0.5 grams of fat, 2.3 grams of carbohydrate, 25 mg of calcium, and 287 mg of phosphorus. According to [2] stated that sweet basil extract contains antimicrobial and antifungal properties so that it can improve the quality of apples in storage. According to [3] stated that sweet basil extract has antioxidant activity and phenolic content. Studied the use of basil leaves in beef and pork which increased the protein content in processed meat by using sweet basil [4]. Traditionally maintained local chicken meat usually has a high level of toughness compared to broiler chicken meat. In addition to the less tender taste, the fishy smell of local chicken meat is one of the factors causing local chicken meat to be less preferred when compared to broiler chicken meat. Several methods of marinating using herbs to improve the physical quality of meat have been carried out.
The purpose of marination is to improve taste, increase tenderness, improve physical quality, and extend shelf life. The spices used can be acid-base [5,6], local herbs containing antibacterial such as *Pangium edule* [7] and onion juice [8]. However, marination using fresh or tonic flavour in local chicken has never been performed. Sweet basil with fresh mint aroma, antibacterial content, nutritional value, and sweet taste from sweet basil leaves are expected to improve the physical quality of local chicken meat. Based on various descriptions and previous studies, the purpose of this study was to find out the physical quality of local chicken meat after marination using sweet basil spices with different concentrations.

2. Materials and methods
The ingredients used consisted of 500 grams fresh basil leaves (*Osmium basilicum*), 2400 grams of local chicken breast, distilled water, KCL, pH meter, moisture meter, penetrometer, electric scales, pans, meat blades, measuring flask, pipette, plastic bags, coolers, straps, filters and measuring cups.

Marinated meats with different concentrations were made by drying and smoothing sweet basil leaves, then adding 1: 2 (w/v) water. Sweet basil leaves were cut into small pieces and then dried. Boiling sweet basil leaves in distilled water used a ratio of 0%, 3%, 6% and 9%. The sweet basil leaves were boiled using 300 ml distilled water in 100°C boiling water for 10 minutes. After boiling, the sweet basil spice solution was then filtered and cooled [9]. The chicken meat is marinated in a sweet basil solution for 15 minutes, dried with a tissue and kept at room temperature for 24 hours.

2.1. Measurement of meat pH
Meat pH was determined on the cut of meat after marinating. PH is measured using a digital pH meter that has been calibrated between 4.0 and 7.0 [10].

2.2. Cooking loss
Cooking loss was measured using the CSIRO method or the meat was weighed and boiled at 80-90 ºC then weighed after 30 minutes. Cooking loss was calculated according to a method by [11].

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\text{Percentage of cooking loss} = \left(\frac{\text{Weight of uncooked sample} - \text{the weight of cooked sample}}{\text{the weight of cooked sample}}\right) \times 100\% \quad (1)
\]

2.3. Tenderness
Meat tenderness was measured using organoleptic from 20 trained panellists with a method by [5].

| Score | Tenderness                  |
|-------|----------------------------|
| 5     | The meat was very tender   |
| 4     | The meat was tender        |
| 3     | The meat was rather tender |
| 2     | The meat was tough         |
| 1     | The meat was Extreme Tough |

2.4. Meat water content
Meat water content was measured using a DM 300 high-frequency moisture meter analyser.

2.5. Drip loss
Meat drip loss was measured by hanging 300 grams of chicken meat in the cooler. Drip loss can be calculated using the following formula:
3. Results and discussion

The physical quality of marinated local chicken meat by using sweet basil leaves for 30 minutes and left at room temperature for 24 hours can be seen in Table 2.

Table 2. Physical quality of marinated local chicken meat with sweet basil

| Parameter         | Physical quality of marinated local chicken meat with sweet basil |
|-------------------|------------------------------------------------------------------|
|                   | 0%                  | 3%                  | 6%                  | 9%                  |
| Meat pH           | 5.53±0.21a          | 5.67±0.22b          | 5.70±0.11b          | 5.71±0.12b          |
| Cooking loss      | 28.48±1.24          | 24.22±2.21          | 23.19±2.53          | 23.92±3.21          |
| Water content     | 69.25±2.12          | 73.77±3.21          | 74.38±3.31          | 75.67±2.83          |
| Tenderness        | 2.45±0.50           | 2.75±0.25           | 3.40±0.25           | 3.35±0.50           |
| Drip loss         | 6.25±1.23           | 3.77±2.24           | 3.58±2.21           | 4.74±2.58           |

Subscript showed significant difference (P<0.05)

3.1. Meat pH

Meat pH showed a degree of acidity in meat. Table 1 showed that the highest meat pH was in P3 (5.71) and the lowest was in P0 (5.53). The results of the study showed that the sweet basil marinade had a significant influence (P<0.05) on meat pH. The HSD test showed that the pH of P0 was significantly lower than P1, P2, and P3. A decrease in meat pH occurs several hours after slaughtering cattle and rigor mortise. The pH showed that the higher the concentration of sweet basil in the process of marination, it would inhibit the pH value to go down faster and lower.

Marination with 3% (P1) and 9% (P3) sweet basil showed that sweet basil stored for 24 hours had not been able to reduce the pH of P0 namely 5.53. It is suspected that sweet basil has antimicrobial content so that at room temperature, the pH of meat is at the isoelectric point. At the isoelectric point, the number of positively charged ions is the same as the number of negatively charged ions so that the total charge becomes zero, meaning that the antimicrobial substances in sweet basil spices can maintain the pH value of the meat under normal conditions. This is in line with a study by [12] which showed that untreated meat had a lower pH than the pH of marinated meat for normal colour. Overall, the pH value in the study was in the normal range which is in line with [13] that the rate of decrease in pH of meat occurred gradually so the final pH was 5.3-5.7.

3.2. Cooking loss

Marination with sweet basil spices with different concentrations had a significant influence (P<0.05) on the percentage of meat cooking loss. The highest cooking loss was in P0 (28.48%) and the lowest in P2 (23.19%). HSD test showed that average cooking loss had a decrease compared to P0 or without treatment.
Good meat quality has a lower cooking loss. Cooking loss is influenced by the ability of meat to bind water, so the lower the percentage of cooking losses, the ability of meat to bind water increases. Cooking loss is also influenced by meat pH, where the higher the pH value, the percentage of cooking loss will decrease. This is in line with several studies that the low meat pH is in line with the increasing percentage of cooking loss, on the contrary, the higher the meat pH makes the percentage of cooking loss low.

Cooking loss was lower than a study by [13] which showed that the average pale chicken of 28.61% and normal meat of 21.10% whereas in marinated pale meat, the cooking loss was 22.38% and normal meat was 24.09 %. Overall, the percentage of cooking loss was very good which is in line with [14] that cooking loss varies in the range of 15% -40%. The best cooking loss was in P2 with 6% sweet basil or 23.19%.

3.3. Meat tenderness

Meat tenderness was measured using organoleptic instruments with 20 trained panellists. Marination with sweet basil spices with different concentrations had a significant influence (P˂0.05) on meat tenderness. Meat without marination produced lower tenderness and was tougher than marinated meat with sweet basil. This is in line with a study by [5] that marinating using Kandis acid spices can increase meat tenderness.

The purpose of marination is to tender the meat to be processed. According to [15] stated that marination can increase meat tenderness and freshness to a certain extent. According to [16] stated that marination can affect tenderness caused by marinade uptake by muscle protein and also collagen dissolution. Based on organoleptic tests, the level of tenderness in a row was P2, P3, P1, P0. In this study, the best result was in P2 or 6% sweet basil marinade.

3.4. Percentage of meat water content

Marination with sweet basil spices with different concentrations namely 0% (P0), 3% (P1), 6% (P2), and 9% (P3) had a significant influence on (P˂0.05) percentage of local chicken meat water content. The highest water content was in P3 (75.67%) and the lowest in P0 (69.25%). HSD test showed that the water content of P0 was significantly lower than P1, P2, and P3.

The average water content of marinated local chicken meat with sweet basil is in line with a statement by [17] that the marinated method can make tenders, improve the taste, and water content of chicken meat. The water content was quite high in this study because marinating with sweet basil spices can maintain the water content and the sweet basil spices do not absorb meat water content. Water content was in a good range based on [18] which showed that chicken meat water content was 68-75%.

3.5. Drip loss

Drip loss is the drop of water from the meat in the storage process when the meat is hung. After 24 hours the meat is hung in a refrigerator, water droplets will usually contain nutrients. Marination with sweet basil spices with different concentrations had a significant influence (P˂0.05) on the percentage of meat drip loss. The highest drip loss was in P0 (6.25%) and lowest in P2 (3.58%). The HSD test showed that the average drip loss was lower than P0.

Drip loss is related to water holding capacity in meat released by muscle protein and related to meat pH. If the meat has a high drip loss then it has a low water-holding capacity and vice versa. The drip loss of this study is in line with a study by [19] which showed that marination using kluwak spice extract for 24 hours had a significant influence on drip loss in the range of 2.01% to 4.22%. The higher the concentration of sweet basil, the higher the value of drip loss. However, when compared to meat without marination or control, the percentage of drip loss was higher. This means that meat with a marinated spice had a better drip loss compared to without marinating [20]. It is suspected that the marinated meat with sweet basil experiences a cooling rate in the refrigerator so that there are changes in the muscle fibres and sarcoma compared to controls. This is the cause of the high value of drip loss in the control
treatment compared to marination using the sweet basil spice [21,22]. This means that sweet basil is a beneficial spice to use [23].

Drip loss is also related to the colour of chicken meat. According to [24] stated that drip loss has a value range of 3.32 to produce normal chicken meat colour and 4.38 or more for pale meat. According to [25] stated that drip loss can be influenced by PSE and DFD meat. According to [26] stated that drip loss with a low category is between 2.60%, the medium category is between 2.60% -4% and the high category is ≥4%. Based on this, the best drip losses were 3.58% and 3.77% or 3% (P2) and 3% (P1) sweet basil marinade.

4. Conclusions
The results of the study showed that marination with sweet basil had a significant influence (P<0.05) on the physical quality of local chicken meat. Sweet basil can reduce the pH value, maintain water content, reduce the percentage of cooking loss, reduce the percentage of drip loss, and increase meat tenderness. It can be concluded that 6% sweet basil marinade (Osimium basilica) can produce the best physical quality of local chicken meat.

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