International Research Journal of Advanced Engineering and Science
ISSN (Online): 2455-9024

The Effect of Concentration and Marination Time with Basil (*Ocimum sp.*) Leaf Extract on Fat Content and Physical Quality of Pork Meat

Rita Dekik Ayuhapsari[1], Sri Hartati Candra Dewi[2], Anastasia Mamilisti Susiati[2]
[1]Bachelor Program, Faculty of Agroindustry, University of Mercu Buana Yogyakarta, Indonesia-55753
[2]Department of Animal Husbandry, Faculty of Agroindustry, University of Mercu Buana Yogyakarta, Indonesia-55753
E-mail: candra@mercubuana-yogya.co.id

Abstract**—***The aim of this research was to determine the effect of concentration and marination time of basil leaf extract on fat content and physical quality of pork meat. The design used was a complete randomized design 4x3 factorial pattern with each treatment combination of 3 replicates. The first factor given was the concentration of basil leaf extract as a marination ingredient with P0 (0%), P1(5%), P2(10%) and P3(15%). The second factor given was the duration of marination with basil leaf extract for L1(2 hours), L2(4 hours) and L3(6 hours). This research showed the results with an average fat content of 2.25%, pH 5.8, water holding capacity 41.20%, cooking loss 19.34% and tenderness 1.16 kg/cm^2. Based on the results of the research, it can be concluded that the best marination combination of 10% basil leaf extract with a marination time of 2 hours is able to reduce fat content, maintain pH value, increase water holding capacity, reduce cooking loss and maintain tenderness of pork meat.*

Keywords**—** *Basil leaf extract, fat content, physical quality, pork meat.*

I. INTRODUCTION

The United States Department of Agriculture (USDA) classified pork as a red meat because it contains more myoglobin than chicken or fish. One of the proteins in meat (myoglobin) holds oxygen in the muscle and the amount of myoglobin in the animal's muscle determines the colour of the meat [1]. Pork has nutritional content such as carbohydrates, protein, vitamins, and minerals, and has the advantage of containing a lot of thiamin which is needed by the body to digest carbohydrates and support the work of the nervous system [2]. *Longissimus Dorsi* (LD) muscle is a very important muscle and forms the eye of the meat when cut from the rib area and from the loin. The LD muscle consists of many muscle subunits, each of which forms the flexibility of the vertebral column and neck movement and respiratory activity [3].

Meat quality test is a must to determine the grade of meat. Meat quality tests include organoleptic, physical and chemical quality tests. There are several indicators used in testing the physical quality of meat, which are pH, water holding capacity, cooking loss and meat tenderness. Intrinsic factors include species, muscle type, muscle glycogen and variability among livestock. While extrinsic factors are environmental temperature, pre-slaughter additive treatment and pre-slaughter stress. When meat stiffness is achieved the pH remains high, between 6.5-6.8. In other livestock, carcass and meat pH can decrease rapidly to 5.4-5.5 within a few hours after slaughter. Meat from these animals will have a final pH between 5.3-5.6 [3].

[3] The water holding capacity (WHC) of meat proteins is defined as the ability of meat to retain its water or added water under the influence of forces such as cutting, heating, grinding and pressure. Meat also has ability to spontaneously absorb water from the environment containing liquid (water absorption). Factors that affect water holding capacity are pH, stress, breed, acto-myosin formation (rigormortis), temperature and humidity, carcass maturation, muscle type, species, age, muscle function, feed, and intramuscular fat. Cooking loss is the weight lost during the process of cooking meat. Different breeds of pigs do not affect the cooking loss value of fresh/pre rigor pork. the cooking loss value of meat varies between 1.5-54.5% with a range of 15-40%. The low cooking loss meat has a relatively good quality compared to the high cooking loss meat, because the risk of losing nutrients during cooking will be less.

One indicator of the chemical quality of meat is fat content. Oxidation of unsaturated fatty acids is more common in meat from non-ruminant livestock including pigs. Intramuscular fat contains variable and relatively small amounts of cholesterol. Muscle that contains relatively no marbling to a relatively moderate amount of marbling has less cholesterol than meat that contains higher marbling [3]. The cholesterol concentration of pork is higher than that of beef and chicken, with pork at 79 mg/100 g, beef at 73 mg/100 g and chicken at 76 mg/100 g. Some treatment is needed to overcome the high fat content contained in pork. The mentioned treatment could be in the reduction of fat content using some herbal ingredients.

Plants used as herbal ingredients are plants that have secondary metabolite compounds. One of the herbal plants in Indonesia that has secondary metabolite compounds is basil leaves (*Ocimum sp*). Basil is a wild-growing perennial plant that can be found on roadsides and gardens. This plant grows in open or slightly shaded soil and is not resistant to drought. Basil has oval-shaped green leaves with a size of about 3 to 4 cm [4]. The stem of the basil plant can be branched with a bright green to dark purple colour and is rectangular with a thickness of up to 6 mm. Basil leaves (*Ocimum sp*.) contain flavonoids, phenols, saponins and essential oil compounds. In general, basil has many properties to facilitate digestion, lower

Rita Dekik Ayuhapsari, Sri Hartati Candra Dewi, and Anastasia Mamilisti Susiati, "The Effect of Concentration aand Marination Time with Basil (*Ocimum sp.*) Leaf Extract on Fat Content and Physical Quality of Pork Meat," *International Research Journal of Advanced Engineering and Science*, Volume 9, Issue 3, pp. 104-109, 2024.

blood cholesterol levels and even minimise the potential for hypertension and heart failure. The content of these compounds can be taken advantage of in the pharmacological field by making extracts from basil plants [5].

Flavonoids are secondary metabolite compounds included in the group of phenol compounds whose benzene structure is substituted with OH groups. This compound is the largest compound found in nature and is contained both in roots, wood, bark, leaves, stems, fruit, and flowers. In general, flavonoid compounds are found in higher plants. About 5-10% of secondary metabolite compounds in plants are flavonoids [6]. Flavonoid compounds are easily oxidised at high temperatures and cannot withstand heat. [7] A research on the effects of basil leaf supplementation on the chemical and physical quality of broiler meat with basil leaves used in the form of flour are added together with broiler feed. The results obtained show that the addition of basil flour as much as 1.25% can improve chemical content, namely increasing protein levels and reducing meat fat content. The supplementation was also able to improve physical quality including improvement in pH value, increase in WHC (water holding capacity) and reduce cooking loss of broiler meat.

The presence of very high fat content in pork is a problem because nowadays people are increasingly adopting a healthy lifestyle. On the other hand, the flavonoids contained in basil leaves can reduce fat levels and increase physical quality on some kind of meat. Based on the description above, research has been conducted which aims to determine the effect of concentration and duration of marination with basil leaf extract on the fat content and physical quality of pork.

II. Materials and Method

A. Sample Preparation and Marination Processing

Preparation of basil leaf extract. Making basil leaf extract is maximum 24 hours before marination is started. Fresh basil leaves as much as 6 kg were sorted to separate the stems and dirt. The fresh basil leaves are then put in black plastic with large holes evenly distributed, and left to dry on a tray. Laying is done in a closed room so that it is not exposed to direct sunlight until the basil dries [8]. Dried basil leaves were crushed using a chopper and then filtered with a sieve to obtain fine powder. The fine powder was then weighed as much as 300 g and dissolved with 2100 ml distilled water, so that a ratio of 1:7 (b/v) was obtained. The solution was heated using a stainlessteel pan for 30 minutes while stirring [9], the hot solution was filtered from the pulp and measured the volume of the result, then evaporated for 1-2 hours at 100^{o}C to obtain a concentrated liquid extract and measured the volume again [10]. A total of 6 kg of fresh basil leaves can be obtained as much as 1300 ml of concentrated basil leaf extract.

Preparation of pork meat samples. The pork meat used was the *Longissimus dorsi* part of a female pig that had been slaughtered. The meat was obtained from a pork trader in Beringharjo Market, Yogyakarta as much as 4.5 kg, then examined in the Nutrition Laboratory, University of Mercu Buana Yogyakarta. The meat was divided into 12 pieces with each piece weighing 150 g, then placed in packaging box that had been labelled with the identity of each treatment.

Preparation of marination solution. Marination solution was obtained from concentrated basil leaf extract mixed with distilled water. Solution P0 (0%) is 500 ml distilled water without basil leaf extract. P1 solution (5%) is 25 ml of basil leaf extract plus 475 ml of distilled water. P2 solution (10%) is 50 ml of basil leaf extract plus 450 ml of distilled water. P3 solution (15%) is 75 ml of basil leaf extract plus 425 ml of distilled water. The solution was made three times as a replicate of each treatment.

Marination process. Marinate the meat according to the treatment requirements. A total of 12 meat samples in a bowl were given the prepared marination solution. One container contains 150 g of meat and marination solution according to the treatment with three replications (3x). The meat must be completely submerged in the solution and kept in an open bowl to avoid anaerobic processes. Marination was carried out separately according to the required duration, namely L1 (2 hours), L2 (4 hours) and L3 (6 hours). Samples that have been marinated according to the required length, then drained for further examination.

B. Experimental Design and Variables

The research was conducted experimentally, the design used was a completely randomised design (CRD) with a 4x3 factorial pattern, the first factor was concentration of basil leaf extract as many as four (4) treatments namely 0% (P0), 5% (P1), 10% (P2) and 15% (P3). The second factor was the duration of marination with basil leaf extract as many as three (3) treatments, namely 2 hours (L1), 4 hours (L2) and 6 hours (L3). Repetition was conducted 3 times in the combination of both factors. The data obtained in this study were analysed using Analysis of Variance (ANOVA) with SPSS version 16, if there is a significant difference then continued with Duncan's New Multiple Range Test (DMRT) [11]. The variables observed in this study were fat content and physical quality of pork meat which includes meat pH, water holding capacity, cooking loss and meat tenderness.

Fat content of meat. Testing the fat content of meat started with the sample is weighed 1 gram and wrapped in filter paper and then placed in the oven for 24 hours. The samples were then weighed in hot conditions and extracted for 18 hours at 80^{o}C with benzene and put back in the oven for 24 hours [12]. The sample was then weighed and calculated using the formula:

$$\text{Fat content (\%)} = ((Y - Z) / X) \times 100\%$$

Description:
Y = weight of sample after oven
Z = weight of sample after extraction
X = sample weight

pH of meat. Meat pH measurement which is using a pH meter, [13] mashed meat sample of 10 g was put into a beaker glass and homogenised with 90 ml of distilled water. The pH measurement is then carried out using a calibrated pH meter.

Water holding capacity. Measurement of water holding capacity was carried out by the pressing Hamm method [3], which involved weighing 0.3 grams of meat sample on a filter

Rita Dekik Ayuhapsari, Sri Hartati Candra Dewi, and Anastasia Mamilisti Susiati, "The Effect of Concentration aand Marination Time with Basil (*Ocimum sp.*) Leaf Extract on Fat Content and Physical Quality of Pork Meat," *International Research Journal of Advanced Engineering and Science*, Volume 9, Issue 3, pp. 104-109, 2024.

International Research Journal of Advanced Engineering and Science
ISSN (Online): 2455-9024

paper between two plates with a load of 35 kg for 5 minutes. The area covered by the flattened meat sample and the area of the surrounding wet area were then marked and measured. The wet area was obtained by subtracting the area covered by the meat sample from the total area (the wet area plus the area covered by the meat sample). The water content of meat can be calculated using the following formula:

$$mgH_2O = (\text{Wet area } (cm^2) / 0.0948) - 8.0$$

The value of water content obtained based on the formula (called free water), then presented against the sample weight of 0.3 grams, so that the formula for free water content is:

$$\% \text{ Free Water} = \{mgH_2O / \text{sample weight (mg)}\} \times 100\%$$

Measurement of total water content is carried out [12] by drying the weighing glass at 105°C for 60 minutes, cooling and weighing (X grams). A 2-gram sample (Y) was placed in a weighing cup and oven-dried for 8-24 hours. The weighing cup containing the sample was cooled and weighed until a constant weight was obtained (Z). Calculation of total water content and water binding capacity value is obtained by the formula:

$$\text{Total Moisture Content } (\%) = ((X+Y) - Z \text{ (gram)}/X \text{ (gram)}) \times 100\%$$

$$\% \text{ Water Holding Capacity} = \% \text{ total water content} - \% \text{ free water content}$$

Cooking loss of meat. The method of measuring cooking loss is by cutting 100 g of meat, weighing and putting it in plastic. The plastic was tightly closed to prevent water ingress during boiling. The sample was heated in a water bath at 80°C for 30 minutes, cooled and weighed [3]. Cooking loss can be calculated using the following formula:

Cooking Loss (%) = {(the beginning weight – the final weight): the beginning weight} x 100%

Meat tenderness. Measurement of meat tenderness using a notch tool (sharpness is ignored) which is placed on a scale [3]. A sample of 100 g was put in plastic and then boiled at 80°C for 30 minutes. The drained and cooled samples were then cut into cross-sections measuring 0.67 cm x 1.5 cm in length in the direction of the meat fibres. The meat samples were assessed for tenderness by measuring the force pressure on the scales required to cut the meat. Meat tenderness is the amount of cutting force (kg) divided by the cross-sectional area (cm^2), denoted as kg/cm^2.

III. Results and Discussion

Fat Content

This research shows that the use of basil leaf extract as a marination ingredient with different concentrations showed significant differences (P<0.05) on pork fat content. Duncan's test results showed the value of P3 (2.25%) was significantly different from P1 (5.91%) and P0 (10.02%), but not significantly different from P2 (2.81%). Based on analysis of variance, the marination time with basil leaf extract at different times showed a significantly different (P<0.05) on the fat content of pork. Duncan test results showed L2 (3.25%) was significantly different from L1 (6.05%) and L3 (6.43%), while L1 (6.05%) was not significantly different from L3 (6.43%).

TABLE I. Fat Content on Pork Meat (%).

Marination Time	Concentration of Basil Leaf Extract				Avg
	P0(0%)	P1(5%)	P2(10%)	P3(15%)	
L1(2 hours)	14,23^{r}	4,7^{p}	3,09^{p}	2,19^{p}	6,05^{a}
L2(4 hours)	5,05^{p}	3,29^{p}	2,39^{p}	2,27^{p}	3,25^{b}
L3(6 hours)	10,77^{qr}	9,74^{q}	2,95^{p}	2,27^{p}	6,43^{a}
Avg	10,02^{c}	5,91^{d}	2,81^{e}	2,25^{e}	

Note: mean values with different superscripts in the same column or row indicate significantly different (P<0.05).

This research showed an interaction (P<0.05) between concentration and marination time using basil leaf extract on pork fat content. The interaction with the lowest fat content was shown in P3L1 (2.19%) while the highest fat content was shown in P0L1 (14.23%). The interaction graph was significantly seen in the treatment with P2 (10%) and P3 (15%) concentrations.

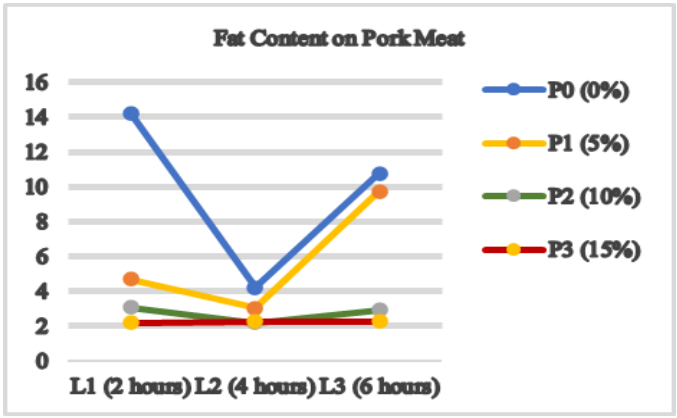

Fig. 1. Interaction graph of fat content

The decrease in fat content of pork meat that given basil leaf extract is caused by the synergy of several active compounds, such as antioxidants, saponins and phenolic compounds in the form of flavonoids. Flavonoid compounds are antioxidants that can inhibit the fat oxidation process using high hydroxyl groups. [14] Antioxidants reduce the oxidation process of unsaturated fatty acids by inhibiting the formation of meat hydroperoxides. When meat is stored, the double bonds of unsaturated weak acids turn into short-chain fatty acids, aldehydes and ketones that can create rancidity. Therefore, meat processing needs the addition of antioxidant compounds that can minimalize the fat oxidation process.

Basil leaves also contain saponins, which are active compounds that, when combined with flavonoids, can reduce the rate of fat absorption. The decrease in the absorption process is offset by an increase in the fat release process. As a result, saponins can directly minimize fat entering the meat muscle [15]. The interaction that occurs between saponins and fat is to increase the ability of membrane permeability by forming a double layer so that fat is difficult to absorb by cells in the meat. The saponin content in basil leaves can inhibit the absorption of fat in pork. Marination using basil leaf extract is able reducing fat content in pork with the presence of flavonoids and saponins compounds in it.

Rita Dekik Ayuhapsari, Sri Hartati Candra Dewi, and Anastasia Mamilisti Susiati, "The Effect of Concentration aand Marination Time with Basil (*Ocimum sp.*) Leaf Extract on Fat Content and Physical Quality of Pork Meat," *International Research Journal of Advanced Engineering and Science*, Volume 9, Issue 3, pp. 104-109, 2024.

pH

Based on the results of analysis of variance, the use of basil leaf extract as a marinating ingredient with concentrations of 0%, 5%, 10% and 15% had a not significantly different effect (P>0.05) on the pH value of pork. Marination time with basil leaf extract at different times showed a significantly different effect (P<0.05) on the pH value of pork. The results of Duncan's test on the marination time showed that the value of L1 (5.4) was significantly different from L3 (5.6) and L2 (6.4).

TABLE 2. Mean Values of pH

Marination Time	Concentration of Basil Leaf Extract				Avg
	P0(0%)	P1(5%)	P2(10%)	P3(15%)	
L1(2 hours)	$5,4^{p}$	$5,4^{p}$	$5,4^{p}$	$5,5^{q}$	$5,4^{a}$
L2(4 hours)	$6,4^{rs}$	$6,5^{s}$	$6,3^{r}$	$6,3^{r}$	$6,4^{c}$
L3(6 hours)	$5,6^{q}$	$5,6^{q}$	$5,6^{q}$	$5,6^{q}$	$5,6^{b}$
Avg^{ns}	5,8	5,8	5,8	5,8	

Note: ns: non-significant
mean values in different superscripts in the same column or row indicate significant differences (P <0.05)

The results of analysis of variance and interaction graph showed that there was an interaction (P<0.05) between concentration and duration of marination using basil leaf extract on the pH value of pork. The interaction graph shows the intersection of lines that intersect clearly, in accordance with the further test data on the interaction of treatment combinations indicated by the letter notation.

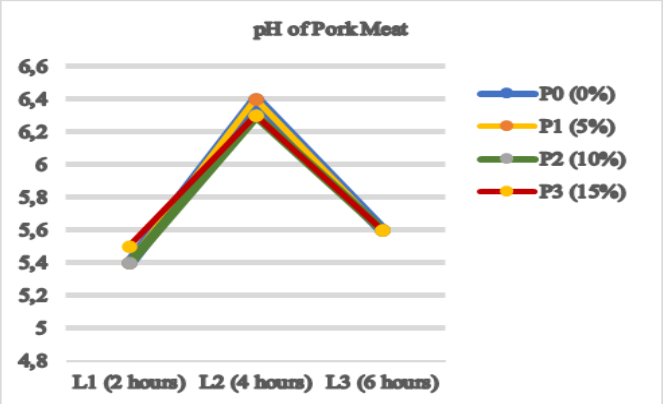

Fig. 2. Interaction graph of pH

Basil leaves contain active compounds in the form of antioxidants and antimicrobials, which cause the pH of the meat to reach the isoelectric point at room temperature. The condition of meat that reaches the isoelectric point has a neutral ion charge. Meat is an ideal medium for microbial growth, that can reduce the chemical and physical quality of meat if the pH is too low or high. The presence of antimicrobials in basil leaves, which are flavonoids, saponins and tannins, can limit the entrance of microbes in large numbers. Antioxidant and antimicrobial substances in basil leaves are able maintain the pH value in normal conditions, so there is no drastic increase or decrease in the pH value of meat. The optimum conditions for microorganism growth are at a temperature of 35-37oC and pH 6.5-7.5. The closer to the normal pH value, the easier it is for microorganisms to grow [16].

The pH value of meat is also caused by the process of glycolysis which occurs anaerobically. Glycogen in the muscle will be converted into lactic acid and if in rigor mortis, the pH of the meat will decrease. Increased glycolysis process by anaerobic bacteria can produce large amounts of lactic acid, so the meat becomes acidic and the pH decreases. If the time that occurs is faster than normal conditions, the resulting meat quality will be low (dark red colour, dry, and tough) and will not be durable in storage even at cold temperatures. In the rigor mortis phase, the glycolysis process will stop and ATP production will decrease, resulting in anaerobic glycolysis that produces lactic acid [17]. When the natural glycolysis occurs, the water holding capacity of the meat increases but the quality of the meat decreases. The importance of fresh meat selection and treatment during storage is used to avoid this glycolysis process. Antimicrobial compounds in basil leaves in the form of flavonoids, saponins and tannins can inhibit the growth of anaerobic bacteria, which suppresses the glycolysis process that occurs and maintains the pH value of the meat during the marination process.

Water Holding Capacity

Based on the results of analysis of variance, the use of basil leaf extract as a marinade ingredient with concentrations of 0%, 5%, 10% and 15% showed significant differences (P<0.05) on the value of water holding capacity of pork.

TABLE 3. Water Holding Capacity of Pork Meat (%)

Marination Time	Concentration of Basil Leaf Extract				Avg^{ns}
	P0(0%)	P1(5%)	P2(10%)	P3(15%)	
L1(2 hours)	18,69	26,38	38,08	40,26	30,85
L2(4 hours)	23,71	25,01	35,8	39,38	30,98
L3(6 hours)	17,99	25,09	22,25	43,96	27,32
Avg	$20,13^{a}$	$25,50^{a}$	$32,04^{b}$	$41,20^{c}$	

Note: ns: non-significant
mean values in different superscripts in the same column or row indicate significant differences (P <0.05)

Duncan test results showed that P3 (41.20%) was significantly different from P0 (20.12%), P1 (25.50%) and P2 (32.04%). While P0 (20.13%) was not significantly different from P1 (25.50%) but significantly different from P2 (32.04%) and P3 (41.20%). During the marination process, an osmosis mechanism occurs so that the meat fibres are evenly filled with the juices and solutions of the marinade ingredients including the active substances in them. The more concentrated the concentration of marinating ingredients used, the higher the water holding capacity formed. [18] Marination solutions are generally made more concentrated, aiming to prevent the release of water from the meat so that the water holding capacity of the meat is optimised. The increase in water holding capacity with basil leaf extract is related to the pH of the meat. During the marination process, the pH of pork can be maintained and does not decrease due to the absorption of basil leaf extract juice. This stable pH condition is an indicator that the meat protein is in good condition and not damaged. Meat protein affects the ability to hold water.

Rita Dekik Ayuhapsari, Sri Hartati Candra Dewi, and Anastasia Mamilisti Susiati, "The Effect of Concentration aand Marination Time with Basil (*Ocimum sp.*) Leaf Extract on Fat Content and Physical Quality of Pork Meat," *International Research Journal of Advanced Engineering and Science*, Volume 9, Issue 3, pp. 104-109, 2024.

International Research Journal of Advanced Engineering and Science
ISSN (Online): 2455-9024

Marination time with basil leaf extract at different times had a not significant effect (P>0.05) on the water holding capacity of pork. This shows that the difference in marination time with basil leaf extract does not affect the increase in water holding capacity of pork. However, the water holding capacity of pork meat can be maintained with the addition of basil leaf extract. The range of water holding capacity in this research is 20.13 - 41.20%, these results are normal because the standard of optimal water holding capacity is 20 - 60% [3]. The antioxidant and antimicrobial content of basil leaves can suppress anaerobic microbial growth in pork. The ability to hold water is related to the stable pH value of the meat, causing the meat protein to be in good condition and the water in the meat can be well held by the meat protein.

Cooking Loss

Based on the results of analysis of variance, the use of basil leaf extract as a marinade ingredient with concentrations of 0%, 5%, 10% and 15% showed significant differences (P < 0.05) on the value of pork cooking loss. The Duncan test results showed that the value of P3 (19.34%) was significantly different from P0 (27.76%), P1 (23.74%) and P2 (24.34%). This shows that marination with the addition of basil leaf extract concentration up to 15% (P3) able to provide the best results in reducing pork cooking loss with a result of 19.34%.

TABLE 4. Cooking Loss of Pork Meat (%)

Marination Time	Concentration of Basil Leaf Extract				Avg
	P0(0%)	P1(5%)	P2(10%)	P3(15%)	
L1(2 hours)	27,05	22,55	18,07	19,59	21,82[a]
L2(4 hours)	22,93	21,3	24,13	16,65	21,25[a]
L3(6 hours)	33,3	27,37	30,81	21,8	28,32[b]
Avg	27,76[c]	23,74[cd]	24,34[cd]	19,34[d]	

Note: mean values with different superscripts in the same column or row indicate significantly different (P<0.05).

The decrease in cooking loss is related to the pH condition and water holding capacity of the meat. The antioxidant and antimicrobial content of basil leaves can maintain the pH value and increase the water holding capacity, then reduce the cooking loss of meat. [3] The cooking loss is an indicator of the quality of the meat, which is related to the amount of water contained in the cells between the muscles of the meat. Meat with higher cooking loss tends to lose more nutrients in it and causes the quality of the meat to be less good. Meat with lower cooking loss has better quality because the nutrients contained in it are not lost as much during the cooking process.

Based on the analysis of variance, the marination time with basil leaf extract at different times showed a significant difference (P<0.05) on the cooking loss of pork. Duncan's test results showed that the value of L2 (21.11%) was significantly different from L3 (27.98%) but not significantly different from L1 (21.65%). This shows that marination with basil leaf extract for 2 hours is the best time for pork cooking loss. [19] The differences in marination duration can cause an increase in cooking loss. The increase in cooking loss is related to the water holding capacity of the meat. The increase in cooking loss with a longer marination period is thought to be due to the content of flavonoids that are easily soluble in water. Heating meat can damage nutrients and active ingredients in meat, making it unable to maintain protein binders in meat. This condition does not valid in water holding capacity because the meat used is fresh meat without heating treatment. The increasing cooking loss with the length of marination time indicates that the longer the basil leaf extract can loosen the muscle fibres, thus accelerating the release of water during cooking.

Tenderness

Based on the results of analysis of variance, the use of basil leaf extract as a marinade ingredient with concentrations of 0%, 5%, 10% and 15% showed significant differences (P<0.05) on the value of pork tenderness. Duncan test results showed the value of P0 (1.93 kg/cm^2) was significantly different from P1 (1.31 kg/cm2), P2 (1.43 kg/cm^2) and P3 (1.16 kg/cm^2).

TABLE 5. Pork Meat Tenderness (kg/cm^2)

Marination Time	Concentration of Basil Leaf Extract				Avg
	P0(0%)	P1(5%)	P2(10%)	P3(15%)	
L1(2 hours)	1,65	1,59	1,44	1,03	1,43[a]
L2(4 hours)	1,57	0,94	1,16	0,94	1,15[a]
L3(6 hours)	2,56	1,4	1,69	1,5	1,79[b]
Avg	1,93[c]	1,31[d]	1,43[d]	1,16[d]	

Note: mean values with different superscripts in the same column or row indicate significantly different (P<0.05).

Basil leaves have active compounds in the form of tannin which indirectly functions as a natural meat tenderiser. Tannin is a compound that able to coat the muscle mucosa so that it inhibits the entrance of microorganisms [20]. The layer created by tannin is also able to inhibit the release of water in the meat during the heating process. The amount of water retained makes the texture of the meat become tender. Based on analysis of variance, marination time with basil leaf extract at different times showed a significant difference (P<0.05) on the tenderness of pork. Duncan's test results showed the values of L1 (1.43 kg/cm^2) and L2 (1.15 kg/cm^2) were significantly different from L3 (1.79 kg/cm^2). Meat tenderness was correlated with water holding capacity and cooking loss. The longer marination time used, the performance of active compounds in basil leaves is optimised due to the increased time for protein hydrolysis. When proteins are hydrolysed, the bonds between fibres are lost and become loose, which causes the meat to become softer. [21] The concentration of the extract solution causes damage through the changing structure of actin and myosin in muscle proteins, which results in a decrease in the ability of muscle proteins to hold water. These activities increase the tenderness of the meat because during the soaking process in the meat there is a process of hydrolysis of muscle protein and the destruction of sarcolema due to thinning. The detachment of muscle fibres results in the muscle tissue becoming tender.

IV. CONCLUSION

The usage of basil leaf extract up to a concentration of 10% and a marination time of 2 hours was able to improve the quality of pork, especially reducing fat content, as well as

Rita Dekik Ayuhapsari, Sri Hartati Candra Dewi, and Anastasia Mamilisti Susiati, "The Effect of Concentration aand Marination Time with Basil (*Ocimum sp.*) Leaf Extract on Fat Content and Physical Quality of Pork Meat," *International Research Journal of Advanced Engineering and Science*, Volume 9, Issue 3, pp. 104-109, 2024.

improving physical quality, which is maintaining pH value, increasing water holding capacity, reducing cooking loss and tenderising pork meat.

REFERENCES

[1] Anonim. 2023. *Tanya USDA, Departemen Pertanian AS*. https://usda.gov/s/article/Is-pork-white-meat accessed on 01 Januari 2024 at 09.30 WIB

[2] Aman, E.P., I.K. Suada., dan K.K. Agustina. 2014. Kualitas Daging Se'i Babi Produksi Denpasar. *Indonesia Medicus Veterinus.* 3(4): 328-333

[3] Soeparno. 2015. *Ilmu dan Teknologi Daging Edisi Kedua.* Gadjah Mada University Press, Yogyakarta

[4] Porte, B. O. 2024. Pengaruh Pemberian Ekstrak Etanol Daun Kemangi (*Ocimum basilicum* L.) terhadap Kadar Albumin. Studi Eksperimental terhadap Tikus Putih Galur Wistar yang Diinduksi CCl4. *Skripsi*, Fakultas Kedokteran, Universitas Islam Sultan Agung Semarang

[5] Kumalasari, M.L.F. dan F. Andiarna. 2020. Uji Fitokimia Ekstrak Etanol Daun Kemangi (*Ocimum basilicum L*). *Indonesian Journal for Health Science.* 4(1): 2649-2748

[6] Ningsih, I. S., M. Chatri., L. Advinda., dan Violita. Senyawa Aktif Flavonoid yang Terdapat pada Tumbuhan. *Serambi Biologi* 8(2) : 126-132

[7] Hamiyanti, A.A., B. Sutomo., A.F. Rozi., Y. Adnyono., dan R. Darajat. 2023. Pengaruh Penambahan Tepung Kemangi (*Ocimum basilicum*) terhadap Komposisi Kimia dan Kualitas Fisik Daging Broiler. *Jurnal Ilmu-Ilmu Peternakan.* 23(1) : 25-29

[8] Cahyani, N.M.E. 2014. Daun Kemangi (*Ocimum cannum*) sebagai Alternatif Pembuatan Handsanitizier. *Jurnal Kesehatan Masyarakat.* 9(2) : 136-142.

[9] Winata, E. W dan Yunianta. 2015. Ekstraksi Antosianin Buah Murbei (*Morus alba* L.) Metode *Ultrasonic Bath* (Kajian Waktu dan Rasio Bahan : Pelarut). *Jurnal Pangan dan Agroindustri* 3(2) : 773-783

[10] Mandei, J. H. 2016. Penggunaan Pati Sagu Termodifikasi dengan Heat Moisture Treatment sebagai Bahan Substitusi untuk Pembuatan Mi Kering. *Jurnal Penelitian Teknologi Industri* 8(1) : 57-72.

[11] Nugroho, S. 2008. *Dasar-dasar Rancangan Percobaan*. UNIB Press, Bengkulu

[12] Astuti, N. 2021. *Petunjuk Praktikum Dasar Nutrisi Ternak*. Program Studi Peternakan, Universitas Mercu Buana Yogyakarta.

[13] Dapamawu, R., G.E.M. Malelak., dan P.R. Kale. Pengaruh Pemberian Ekstrak Tepung Rosela (*Hibiscus sabdarifa* Linn) terhadap Sifat Fisik dan Kimia Dendeng Babi. *Jurnal Nukleus Peternakan* 8(1): 33-39.

[14] Zainal, T. R., P. R. Kale, dan G. E. M. Malelak. 2021. Kualitas Daging Se'i Sapi yang Diproses Menggunakan Buah Belimbing Wuluh (*Averrhoa Bilimbi* Linn) Kering Matahari. *Jurnal Sain Peternakan Indonesia* (16) 2:194-201

[15] Agustina, K.K., P. H. Sari., dan I. K. Suada. 2017. Pengaruh Perendaman pada Infusa Daun Salam terhadap Kualitas dan Daya Tahan Daging Babi. *Buletin Veteriner Udayana*, (9)1 : 34-41

[16] Nopandi, Hendra., R.I. Pratama., A.A.H. Suryana., I. Rostini. (2019). Penambahan Ekstrak Kunyit Terhadap Karakteristik Presto Ikan Nilai yang Disimpan pada Suhu Kamar. *Jurnal Perikanan dan Kelautan* 10 (2) : 50-55.

[17] Siswanto dan I. G. Soma. 2021. Studi Asam Laktat Pasca Pemotongan pada Babi di Rumah Potong Hewan, Denpasar, Bali. *Buletin Veteriner Udayana* 14(2) : 148-153

[18] Brigitha, M. S. 2022. Review Perkembangan Teknologi Marinasi Berbahan Alami pada Daging Ayam untuk Mengetahui Keterkaitannya terhadap Perubahan Mutu Daging. *Skripsi*, Fakultas Teknologi Pertanian, Universitas Katolik Soegijapranata Semarang.

[19] Rahayu, P. I. S., I. N. S. Miwada., dan I. A. Okarini. Efek Marinasi Ekstrak Tepung Batang Kecombrang terhadap Sifat Fisik dan Organoleptik Daging Broiler. *Majalah Ilmu Peternakan* 23 (3) : 118-123.

[20] Prihandani, S. S., S. M. Noor., Andriani, dan M. Poeloengan. 2016. Efektivitas Ekstrak Biji Mangga Harumanis terhadap *Staphylococcus aures*, *Bacillus subtilis*, *Shigella sp*., dan *Escherichia coli*. *Jurnal Veteriner* 17 (1) : 45-50

[21] Nurjaya, M. I. Y., O. R. Puspitarini., dan I. D. Retnaningtyas. Pengaruh Berbagai Konsentrasi Asam Jawa terhadap Kadar Air, WHC (*Water Holding Capacity*) dan Keempukkan pada Daging Ayam Petelur Afkir. *Jurnal Peternakan Lokal* 5(2) : 116-122

Rita Dekik Ayuhapsari, Sri Hartati Candra Dewi, and Anastasia Mamilisti Susiati, "The Effect of Concentration aand Marination Time with Basil (*Ocimum sp*.) Leaf Extract on Fat Content and Physical Quality of Pork Meat," *International Research Journal of Advanced Engineering and Science*, Volume 9, Issue 3, pp. 104-109, 2024.