EFFECT OF ADDING RED GINGER (*Zingiber officinale rosc*) JUICE ON THE PHYSICAL AND ORGANOLEPTIC QUALITY OF LAMB MEAT DRIVE

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Abstract: *This study aims to determine the physical and organoleptic quality of lamb jerky marinated using red ginger juice with different concentrations in each treatment. The research design used was a Completely Randomized Design (CRD) consisting of 4 treatments and 5 replications. The treatments included: Without red ginger (P0) as a control, Marinated with 10% red ginger juice (P1), Marinated with 15% red ginger juice (P2), and Marinated with 20% red ginger juice (P3). Physical test parameters include water holding capacity, pH, and cooking loss. Meanwhile, organoleptic test parameters include color, taste, aroma and texture. The results of physical tests in this study showed that the treatment had a very significant effect (P<0.01) on water holding capacity, pH and cooking loss. Meanwhile, the organoleptic test results showed that the treatment had a very real influence (P<0.01) on color and texture, but the taste variable in the organoleptic test showed that the treatment did not have a real influence (P>0.05). Marinating using red ginger juice can provide a level of acceptance of the organoleptic properties of lamb jerky, especially in color, aroma and texture*

PENDAHULUAN

Food from meat is a food source that is rich in protein and essential amino acids that are complete and balanced and are important for human health and growth. In Indonesia, sheep meat is one of the livestock commodities that produces animal food meat which is widely consumed by the public. Lamb is an animal food that is very beneficial for humans. Lamb has high nutritional value because lamb is rich in protein, fat, vitamins and minerals. Lamb has a lot of nutritional content so it is a good medium for microbes. Meat is a perishable food because bacterial contamination in food can reduce its quality and cause animal food to spoil easily (Walalangi, 2013). Natural ingredients that are known to have antimicrobial substances and can inhibit microbial growth are ginger rhizomes.

Ginger is a type of spice that is often added to cooking products to enhance the taste. The main components in ginger are gingerol, shogaol, and zingeron. In research conducted by Destriyana et al., (2013), ginger juice with a concentration of 10% with different storage times at a temperature of 5˚C was proven to be able to suppress the growth of destructive

bacteria better. compared to turmeric in pork. Apart from being able to suppress the growth of damaging bacteria in meat, red ginger is also believed to influence the pH value of meat.

Yadnya et al., (2010) stated that the pH value is influenced by hydrogen ions, one way to influence the pH value is by adding red ginger extract. Red ginger contains proteolytic enzymes which are thought to be able to use H+ ions to provide an energy source in the glycolysis process so that it can inhibit the formation of lactic acid. According to Sari et al. (2017) soaking discarded dairy beef with a red ginger solution concentration of 10% for 30 minutes produced meat with the best level of tenderness and the lowest pH value.

The tenderness of meat is a factor that greatly influences meat-based preparations, because the tenderness of meat can be an added value apart from the combination of bunbu. The tenderness of the meat makes the processed product more delicious and has a high taste, especially in processed meat such as beef jerky.

Dendeng is a traditional Indonesian dried meat, generally produced using several spices and sugar with a sweet and spicy taste, and is stable for several weeks at room temperature (Suryati et. al (2014). Dendeng is also a type of food that applies technology drying to reduce the water content in food until it is considered safe enough to suppress the growth and reproduction of bacteria (Suradi et al., 2017).

Based on this background, researchers are interested in conducting research on the effect of marination using red ginger juice in improving the physical and organoleptic quality of lamb jerky.

RESEARCH METHODS

This research was carried out in January – February 2024 at the Microbiology Laboratory, Faculty of Science and Technology, Panca Budi Development University. The ingredients used in this research were the thigh meat of a ram aged more than 1 year and red ginger obtained from traditional markets. The cooking spices used consisted of garlic, shallots, curly red chilies, large red chilies, tamarind water, salt, granulated sugar, seasoning and ground pepper. The tools used are scales, clear plastic, knives, cutting boards, petri dishes, test tubes, beakers and labels, as well as cooking utensils in the form of containers, pans, knives, plates, cutting boards and sutils.

The research method used in this study was a non-factorial Completely Randomized Design (CRD) method with 4 treatments and 5 replications and the weight of the sheep sample was 200 gr/replication. The treatment given is as follows:

P0 = Lamb without red ginger juice marination (control),
P1 = Marinate for 30 minutes using 10% red ginger juice,
P2 = Marinate for 30 minutes using 15% red ginger juice,
P3 = Marinate for 30 minutes using 20% red ginger juice.

The data obtained were analyzed using analysis of variance, significant differences between treatments were further tested using Duncan's multiple range test (DMRT).

Research Implementation

The meat used is the thigh meat of a ram aged more than 1 year which has been washed clean, the meat is cut 1cm x 5cm with a thickness of ±0.5 cm, the cutting path is in the direction of the meat fibers. Then prepare to make red ginger juice by selecting red ginger rhizomes that are intact and not rotten; Peel the ginger skin; Wash the ginger rhizomes until

clean, then blend the red ginger rhizomes until smooth by adding water according to the concentration of the ginger solution (w/v), namely:

a. 10% red ginger (100 grams of ginger rhizome blended and 90 ml of water added to make the weight 100 ml);
b. 15% red ginger (150 grams of ginger rhizome blended and 85 ml of water added to make the weight 100 ml);
c. 20% red ginger (200 grams of ginger rhizome blended and 80 ml of water added to make the weight 100 ml).

Next, the meat that has been cut weighing 200g for each repetition is marinated with red ginger juice at a concentration of 10%, 15% and 20% for 30 minutes until the red ginger juice is absorbed into the meat. After marinating, the meat is cleaned, then stored for 10 hours in the refrigerator, then a physical quality test is carried out to determine water holding capacity, pH and cooking loss.

Water Holding Capacity

Test the total water content. The first thing to do is take a sample that has been weighed and record it (x), wrap the meat in filter paper (y) and give it an identity, put the sample in the oven at 1050C for 1 day, after 1 day take the sample in the oven then weighed (z), then calculate using the following formula:

$$\text{Total water content} = \frac{(x+y)-z}{x} \text{ x } 100$$

After getting the free water content value and total water content value, then calculate the percentage of water holding capacity using the following formula:

% water holding capacity = total water content – free water content.

pH value

Carcass pH values are measured using a pH meter standardized to a certain pH. The sample used was thigh meat. The tip of the electrode is pressed against the surface of the meat in several places. The tip of the pH meter electrode is removed from the surface of the meat when the pH value reading is constant.

Reduce Cooking

The meat sample is weighed weighing ± 20 g in the form of a block with a cross-sectional size of approximately 2 x 3 cm with the direction of the muscle fibers parallel to the end of the sample, then put into a plastic clip then labeled and closed tightly so that when boiling water cannot enter the bag. plastic, then the samples were boiled in a water bath at 80°C for one hour. Cooking loss (SM) is calculated using the formula:

$$CL = \frac{B1-B2}{B1} \text{x} 100\%$$

Information:
B1 = initial weight of the sample
B2 = weight loss
CL = Cooking Loss Value % (Soeparno, 1992).

Organoleptic Test

Organoleptic tests are carried out subjectively (panelist test). The panelist test was

carried out using a hedonic scale, namely using numbers. The method of testing the level of liking used is scoring. The number of panelists required for this test is 20 people. The panelists are active students at the Faculty of Science and Technology, Panca Budi Development University, Medan. Each panelist will be given 4 samples which will be tested for their level of liking against 4 test criteria, namely color, aroma, taste and texture with a score of 1 (very bad), 2 (not good), 3 (fairly good), 4 (good), and 5 (very good).

RESULTS AND DISCUSSION

1. Test the physical quality of lamb jerky marinated in red ginger juice

Table 1. Recapitulation of Mean Physical Test Results for Lamb Meat Marinated with Red Ginger Juice

Treatment	Parameter		
	Water Holding Capacity	pH	Reduced Cooking (%)
P0	$69,0^{A}$	$6,6^{C}$	$53,0^{C}$
P1	$74,0^{AB}$	$5,7^{AB}$	$49,0^{BC}$
P2	$77,0^{B}$	$5,6^{A}$	$36,0^{A}$
P3	$76,0^{AB}$	$5,9^{B}$	$45,0^{B}$

Note: different superscripts on the same line are very significantly different (P<0.01).

Water Holding Capacity

The average water holding capacity of lamb can be seen in table 1. The results of variance showed that the process of marinating lamb with red ginger juice had a very significant effect (P<0.01) on the water holding capacity of the meat. The results of this research show that marinating for 30 minutes using red ginger juice with different concentrations has an effect on the water holding capacity of meat, namely providing longer time for ginger juice which contains proteolytic enzymes to work, so that the water holding capacity value increases. Proteolytic enzymes can damage muscle membranes resulting in diffusion of ions into meat proteins. This is in accordance with Soeparno's (2011) statement which states that proteolytic enzymes are partly responsible for changes in muscle cell membranes.

The results of further tests using the DMRT test showed that lamb meat that was not marinated in red ginger juice (P0) was very significantly different from the water holding capacity of lamb meat that was marinated for 30 minutes in 15% red ginger juice (P2). The water holding capacity of lamb marinated for 30 minutes with 10% red ginger juice (P1) was significantly different from the water holding capacity of lamb marinated for 30 minutes with 20% red ginger juice (P3). From the test results it can be seen that there is a significant increase in water holding capacity from (P0) to (P2), but it decreases again at (P3). This can be caused by the denaturation and depolymerization processes as well as an increase in the solubility of meat protein during boiling which causes changes in the structure of muscle proteins, especially actin and myosin. Water holding capacity is also influenced by the amount of myofibrillar protein in meat, the higher the myofibrillar protein is damaged, the lower the value of water holding capacity because more protein is denatured (Hartono et al., 2013).

pH

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The average physical quality test results of lamb marinated using red ginger juice on pH parameters can be seen in table 1. The results of the analysis of variance obtained showed that marinating lamb using red ginger juice had a very significant effect ($P < 0.01$) on the pH of lamb. This was shown in the treatment between concentrations (10%, 15% and 20%) which was able to reduce the pH of lamb meat to be lower than the pH of lamb meat that was not marinated in red ginger juice P0 (control). Based on the physical quality test recapitulation table above, it can be seen that the pH of lamb marinated using red ginger juice is still within the normal range. This is in line with the opinion (Skovgaard, 2004), that pH is used to indicate the level of acidity which decreases after slaughter because it undergoes glycolysis and forms lactic acid, with the normal pH of meat around 5.5 after slaughter.

The DMRT test results showed that the lowest pH value was found in lamb meat that was marinated for 30 minutes with red ginger juice at a concentration of 15% (P2) of 5.6A, and the highest pH value was found in lamb meat that was not marinated in red ginger juice P0 (control) of 6.6C. From the test results it can be seen that there is a decrease in pH from (P0), namely 6.6C, to (P2), namely 5.6A, but it increases again at (P3), namely 5.9B. This can occur due to an increase in the concentration of red ginger used in the lamb meat marination process. Red ginger contains phenolic compounds which are alkaline, so the pH of lamb meat is affected by the pH of the ginger juice used (Suryanti et al., 2015). The increase in pH can also be caused by protein degradation, including ammonia and producing trimelamine. Protein degradation can occur due to the protease enzyme (zingibain) in red ginger which can break down protein. So the higher the concentration of red ginger used, the higher the pH of lamb marinated in red ginger juice (Suryanti et al., 2015).

Reduce Cooking

The results obtained from the physical quality test of lamb showed that marinating the meat for 30 minutes using red ginger juice with different concentrations had an effect on the cooking loss of lamb. Based on the Anova results, the cooking loss of lamb that was not marinated using red ginger juice (P0) was significantly higher than the cooking loss of lamb that was marinated for 30 minutes using red ginger juice with different concentrations in treatments (P1), (P2), and (P3). The cooking loss of lamb that is not marinated using red ginger juice (P0) is very significantly different from the cooking loss of lamb that is marinated for 30 minutes using 15% red ginger juice (P2), while the cooking loss of lamb that is marinated for 30 minutes using red ginger juice is 10 % (P1) is significantly different from the cooking loss of lamb marinated for 30 minutes using 20% red ginger juice (P3). The reduction in cooking loss of lamb is influenced by the presence of protease enzymes found in red ginger which can reduce the value of cooking loss in lamb. According to Soeparno (2009) normal cooking losses for beef range from 15-40%.

In this study, the cooking losses obtained in P1 and P3 were higher than the normal range, but in P2 the cooking losses were lower than the normal range and the results reported by previous researchers. However, overall, the percentages in this study are quite good. The presence of protease enzymes contained in red ginger can reduce the cooking loss value of meat if marinated using red ginger juice so that during cooking it affects the nutritional quality of the meat. This is in accordance with the opinion of (Suantika et al., 2017), that enzymes play a role in hydrolyzing peptide bonds into simpler peptides so that

the loose structure of the meat can cause high water content in the meat. This is in accordance with the opinion (Prayitno et al., 2020) that cooking loss is a determinant of meat quality because it is related to the water content in the cooking process.

2. Organoleptic Test of Lamb Jerky Marinated with Red Ginger Juice

Table 2. Recapitulation of Mean Organoleptic Results of Lamb Jerky Marinated with Red Ginger Juice

Treatment	Parameter			
	color	flavor	Aroma	texture
P0	$4,0^{B}$	$3,6^{tn}$	$3,4^{a}$	$2,7^{A}$
P1	$4,85^{C}$	$3,85^{tn}$	$3,7^{b}$	$3,9^{B}$
P2	$3,9^{AB}$	$4,2^{tn}$	$4,1^{c}$	$4,2^{BC}$
P3	$3,7^{A}$	$3,9^{tn}$	$3,7^{b}$	$4,4^{C}$

Note: Different superscripts on the same line indicate very significant differences (P<0.05) and very significantly different (P<0.01);

Color

The average organoleptic test results for lamb jerky can be seen in Table 2. The panelists' assessments ranged from 3.7 to 4. It can be seen that there was an increase in the panelists' assessments from treatment P0 (control) to treatment P1, but again decreased in treatments P2 and P3. The results of analysis of variance showed that the concentration of red ginger used in the marinating process was very significantly different (P<0.01) to the color of lamb jerky. It is suspected that the use of red ginger at a concentration of 10% (P1) has a quite significant influence on the color of the jerky, however, the process of marinating the meat at a concentration of 15% (P2) and a concentration of 20% (P3) has an influence on the color of the jerky which tends to be slightly red. blackish (dark red), this occurs because the higher concentration of red ginger is used. Another factor that is the main determinant of meat color is the concentration of myoglobin and hemoglobin, which is also caused by the non-enzymatic browning reaction between meat proteins containing amino acids and reducing sugars (Tiven et al., 2007). According to Jhon, (2003), color has an important role in determining the level of preference for a type of food in addition to shape and size. Color is the quickest to make an impression, but the most difficult to describe and measure. Therefore, subjective assessment by sight is still very decisive in food research.

Flavor

The variance results obtained showed that marinating lamb using red ginger juice with different concentrations had no significant effect on the taste of lamb jerky (P>0.05). The results of the anova test show that jerky marinated with red ginger juice at a concentration of 15% (P2) has the highest average rating in the organoleptic test for jerky taste. Apart from that, the concentration of 10% (P1) and concentration of 20% (P3) were significantly higher than the assessment of beef jerky that was not marinated using red ginger juice (P0). The reason that can be put forward in this research is because the taste of lamb jerky influences the combination of kitchen spices in the process of making lamb jerky. Because the researchers used the same combination of kitchen spices when cooking beef jerky for treatments P0, P1, P2 and P3, the taste of the resulting lamb jerky was not that different between lamb jerky that was not marinated in red ginger juice and the taste of beef jerky that was marinated in ginger juice. red. According to Winarno (2002) states that the taste of

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food ingredients can be influenced by texture, while taste is an important factor in the consumer's final decision to accept or reject a food even though the color, aroma and texture are good. However, if it doesn't taste good, consumers will reject the food. Lamb jerky marinated using red ginger juice does not change the taste of the jerky to red ginger flavor, this may happen because the time used in the marinating process is not too long.

The optimal time for the marinating process is around 30 minutes. If soaking is done for too long it will certainly affect the taste of the meat. Meat will taste spicy if it is marinated for too long using red ginger juice because ginger has a dominant spicy taste caused by oleoresin and terpenoid derivative compounds in ginger such as the sesquiterpene Zingiberene which also makes a sensory contribution in the form of a warm taste. Ibrahim et al., (2015) stated that ginger oleoresin contains many spicy and bitter taste-forming components that do not easily evaporate (non-volatile oil). The components of ginger oleoresin consist of gingerol, zingiberene, shaogol, essential oils and resin.

Aroma

The results of observations for the organoleptic test of lamb jerky marinated with red ginger juice on the aroma of beef jerky can be seen in Table 2. The table shows that the panelists' assessments ranged from 3.4 to 4.15 (quite fragrant). There was an increase in panelist assessments from P0 (control) to P2 (15% concentration), then decreased again at P3 (20% concentration). Jerky marinated using red ginger juice at different concentrations was significantly preferred by panelists compared to jerky not marinated with red ginger juice (P0). The fragrant aroma of red ginger can increase the level of panelists' liking for the aroma of the lamb jerky produced. In research conducted (Mega et., al 2009) panelists preferred the aroma of jerky meat from rejected laying hens that was given 15% ginger, because it was more fragrant compared to beef jerky that was not given ginger and beef jerky that was given 5% ginger.

Further tests using the DMRT test on the aroma of beef jerky showed that treatment P0 was significantly different ($P<0.05$) to P2, and treatment P1 was not significantly different ($P>0.05$) to P3. This is due to the distinctive aroma produced by the essential oil content in ginger which causes a fragrant smell, however if the level of red ginger powder given is too high it will cause the aroma of lamb jerky to be too piercing to the nose which then causes the panelists to not like the aroma of lamb jerky the. Susanti (2003), states that smell and taste can be identified as something that is observed with the senses. Taste is acceptable or not and can be used to determine whether consumers like or not a particular type of food. In general, taste control to determine consumer acceptance is done using sensory devices.

Texture

The results of observations on the organoleptic test of lamb jerky on the texture of beef jerky in Table 2 show that the panelists' assessments ranged from 2.7 (not smooth) to 4.4 (smooth). The texture of processed meat products is influenced by water, fat and protein content. Protein coagulation, collagen gel ethanization, water release and starch gel etanization are factors that influence texture changes. The process of marinating meat using red ginger can make the resulting jerky texture softer and more tender. Because red ginger contains a protease enzyme, namely zingibain, which can break peptide bonds in meat proteins so that the proteins form molecules (minor bands) which can tenderize meat (Kurniawan, 2014).

The results of analysis of variance showed that marinating lamb for 30 minutes using red ginger juice at different concentrations had a very significant effect (P<0.01) on the texture of lamb jerky. The process of marinating lamb meat using red ginger juice in treatment P1 to treatment P3 experienced a significant increase from P0. This is because meat protein undergoes changes by proteolytic enzymes in red ginger extract at different concentrations. Protease enzymes work actively to hydrolyze muscle proteins that make up the structure of meat, namely actin and myosin as well as connective tissue consisting of collagen, elastin and reticulin. By breaking down the meat proteins actin and myosin as well as breaking down the connective tissue collagen, elastin and reticulin, this will give the meat a soft texture so that it becomes tender (Chandra, 2015).

CONCLUSION

From the results of the research and discussion it can be concluded that:

1. Marinating using red ginger juice at a concentration of 15% (P2) is the best treatment for physical tests because it can increase water holding capacity, reduce pH, and reduce cooking losses of lamb.
2. Marinating using red ginger juice at a concentration of 10% (P1) is the best treatment for organoleptic tests because it can affect the color of the lamb jerky produced, namely red. Meanwhile, for the texture variable, 20% concentration (P3) is the best treatment which was given the highest rating by the panelists (very smooth).
3. Marinating using red ginger juice can affect the physical quality of the meat and provide a level of acceptance of the organoleptic properties of processed lamb jerky.

SUGGESTION

The process of marinating the meat for 30 minutes using red ginger juice with a concentration of 15% can be used as the best tenderizer for lamb that can be used by the public and on an industrial scale in processing lamb.

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