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POTENTIAL OF PATIKALA FRUIT (*ETLINGERA ELATIOR*) IN IMPROVING THE PHYSICAL QUALITY OF SPENT LAYING CHICKENS MEAT

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Abstract
Patikala (*Etlingera elatior*) is a local Indonesian plant that contains many secondary metabolic compounds and also containt acid compounds. These compounds have a potential to be useed as natural ingradient in imporoving the quality of spent layer meat. This study aims to determine the potential of patikala fruit as a local plant in improving the physical quality of spent layer hen meat. This research used a completely randomized design, with 5 treatments and 4 replications. The research design was determined based on the amount of meat used, namely soaking spent layer meat without patikala extract water concentration (T0=0%), the using patikala extract concentration (T1=25%), patikala extract concentration (T2=50%), patikala extract concentration (T3=75%), patikala extract concentration (T4=100%). The parameters observed were the physical quality of the meat, namely pH, cooking loss, tenderness and water-holding capacity. The results showed that soaking patikala extract had a very significant effect on improving the physical quality of spent layer chicken meat based on pH values and cooking losses, but no significant effect on the tenderness and water holding capacity of meat.
Keywords: Patikala Fruit (*Etlingera elatior*), Physical Quality, Spent Layer Meat

POTENSI BUAH PATIKALA (ETLINGERA ELATIOR) DALAM MENINGKATKAN KUALITAS FISIK DAGING AYAM PETELUR AFKIR

Abstrak
Patikala (Etlingera elatior) merupakan tanaman lokal Indonesia yang mengandung senyawa metabolit sekunder dan senyawa asam yang dapat digunakan untuk meningkatkan kualitas daging ayam petelur afkir. Penelitian ini bertujuan untuk mengetahui potensi buah patikala sebagai tanaman lokal dalam meningkatkan kualitas fisik daging ayam afkir. Metode penelitian ini menggunakan Rancangan Acak Lengkap (RAL) dengan 5 perlakuan dan 4 kali ulangan. Desain penelitian ditetapkan berdasarkan total daging yang digunakan yaitu perendaman daging ayam afkir tanpa konsentrasi ekstrak patikala (T0 = 0%), perendaman daging ayam afkir dengan konsentrasi ekstrak patikala (T1 = 25%), perendaman daging ayam afkir dengan konsentrasi ekstrak patikala (T2 = 50%), perendaman daging ayam afkir dengan konsentrasi ekstrak patikala (T3 = 75%), dan perendaman daging ayam afkir dengan konsentrasi ekstrak patikala (T4 = 100%). Parameter yang diamati adalah kualitas fisik daging, yaitu pH, susut masak, keempukan dan daya ikat air. Hasil penelitian menunjukkan bahwa, perendaman ekstrak patikala berpengaruh sangat nyata terhadap peningkatan kualitas fisik daging ayam afkir berdasarkan nilai pH dan susut masak, namun tidak berpengaruh nyata terhadap nilai keempukan dan daya ikat air daging.
Kata Kunci: Buah Patikla, Daging Ayam Petelur Afkir, dan Kualitas Fisik

INTRODUCTION

Spent layer chicken meat has a tougher texture compared to broiler-type chickens due to the relatively older slaughter age of spent hens. On the other hand, spent layer chicken meat is a livestock commodity that contributes to meeting national animal protein needs. Spent layer hen meat, containing a high protein of 25.4% (Yahya *et al.*, 2018), is susceptible to high microbial growth, resulting in a rapid decline in its physical quality and potential meat damage (Hafid *et al.*, 2017). Refrigeration helps overcome this problem by inhibiting microbial growth, however, it does not eliminate microbes entirely. Freezing is another alternative, but problems are still found, especially in remote areas with unstable electrical currents (Patriani *et al.*, 2021).

Another effort to maintain meat's physical quality is by adding synthetic chemicals such as formalin, borax, and sodium nitrate. However, these chemicals are dangerous to health

(Patriani *et al*, 2020). Considering the dangers of using formaldehyde as a preservative in meat, efforts are needed to find preservatives from natural ingredients. Several studies show that native Indonesian spices contain antimicrobial active substances, making them potential candidates as natural preservatives. One such effective antibacterial ingredient is the patikala fruit extract.

The patikala plant (*Etlingera elatior*) belongs to the *Zingiberacea* family, a local spice widely distributed in Indonesia. This plant is known by various names, including "Kencong" or "Kincung" in North Sumatra, "Sambuang" in West Sumatra, "Kecombrang" in Java, "Honje" in Sunda, "Bongkot" in Bali, "Katan Flower" in Kalimantan and "Patikala or Katimbang" in South Sulawesi (Perdana *et al*, 2016), and it is well known and used by the locals. Especially in Luwu Regency, South Sulawesi, this plant is a favored spice for traditional foods for its unique sour and astringent taste, accompanied by distinctive aroma. Its use is still limited to traditional food, making it necessary to increase its function towards technological development, especially in its application in the livestock products industry.

The patikala plant is a wild-growing shrub with an erect false stem, reaching a height of 1-3 m. Its midrib forms a green rhizome, with fibrous roots, and single lanceolate leaves measuring 20 -30 cm in length and 5-15 cm in width, with pointed yet flat tips and bases. It has pinnate leaf veins, and the flower stalks are around 40–80 cm, with cob-shaped, pink-coloured flowers. The fruit is box-shaped or egg-shaped, appearing in white or pink hues, and contains small brown seeds with a strong sour taste (Yusran & Muhammad, 2018). The nutritional content contained in patikala fruit is 4.4 g carbohydrates, 1.2 g dietary fibre, 1.0 g fat, 1.3 g protein, 91 water, 32 mg calcium, 4 mg iron, 27 mg magnesium, 30 mg phosphorus, 541 mg potassium 0.1 zinc (Sari *et al*., 2021). Other research indicates that patikala fruit contains bioactive compound components such as alkaloids, polyphenols, flavonoids, and essential oils as well as chlorogenic acid, which plays an active role as an antibacterial and antioxidant (Naufalin, 2005). The total phenolic content in the methanol extract of patikala fruit is 2.29% w/w, and the methanol flavonoid content of patikala fruit is 1.77% w/w (Ahmad *et al*., 2015).

The flavonoid content found in patikala fruit functions as a bacteriostatic agent which inhibits microbial growth. The catechin content in flavonoids works by denaturing proteins from bacteria. Proteins that experience denaturation will lose their physiological activity. When a protein is denatured, all cell metabolic activities are catalyzed by enzymes causing bacteria to survive and not function properly. Changes in the protein structure of the bacterial cell wall lead to increased cell permeability, hampering cell growth and eventually causing cellular damage. It is hoped that the active biological compounds in patikala fruit can act as anti-bacterial agents, thereby improving the physical quality of spent layer chicken meat. This rationale is the basis for researching the application of patikala fruit extract to improve the physical quality of the spent layer chicken meat.

MATERIALS AND METHODS

Research Materials

The research materials used were 1.250 g of spent layer chicken meat, 1.000 g of patikala fruit, and 1.250 mL of distilled water. The tools used include test tubes, digital pH meters, digital thermometers, analytical scale breakers, blenders, trays, polyethylene plastic, Styrofoam boxes, and spoons.

Research Methods

Preparation Phase

Selection of Spent Layer Meat and Patikala Fruit

The selected chicken meat was the meat of spent layer chicken, taken from its lower thighs, obtained from the Chicken Slaughterhouse in Makassar City, and weighed 1.250 g. Patikala fruit weighing 1.000 g was obtained from Luwu Regency, South Sulawesi Province. The type of patikala fruit used is pink patikala fruit which has reached a perfect level of maturity.

Extraction of Patikala Fruit

The selected fresh patikala fruit was washed with running water. After draining, it was dried and mixed with distilled water according to the treatment specifications. Subsequently, the mixture was blended to achieve the finest level of smoothness and then filtered to separate the pulp from the water.

Implementation phase

Meat Soaking

Meat preparation begins by separating the purchased spent chicken meat from the bones. Each chicken meat piece was individually placed into a plastic clip and stored in a Styrofoam box containing ice cubes to maintain the meat condition's stability and temperature. Subsequently, the meat was weighed to 250 g for each treatment.

Soaking begins by removing the chicken meat from the plastic clip and immersing it in 250 mL of distilled water, added with patikala fruit extract according to each treatment: without patikala fruit extract (P0); 25 mL of patikala fruit extract (T1); 50 mL of patikala fruit extract (T2); 75 mL of patikala fruit extract (T3); and 100 mL of patikala fruit extract (T4). The meat was then marinated for ± 30 minutes, with an optimal limit of 15 minutes as it does not damage the color texture, and smell, with the expectation that the physical value and chemical value of meat are still above the National Standard (Barus 2009). Following margination, the samples were transferred to a tray, placed in a polyethylene plastic, and left at room temperature for the next sample to be observed.

pH Measurement

The pH meter was calibrated first using pH buffers 4 and 7. Meat that had been soaked was weighed 10 g, finely chopped, then placed in a small plastic tube, and added with 10 mL of distilled water. The pH meter was dipped in the meat sample, and the results were read on the digital screen of the pH meter (Usman *et al*., 2023).

Cooking Loss

Cooking loss was measured by cutting 2 x 2 x 2 cm^3 sections of chicken meat, weighing them, and sealing them in polyethylene plastic to prevent water from entering the plastic during boiling. The meat samples were then put into a water bath at 80°C for 1 hour (Soeparno, 2005). After boiling, the samples were cooled in a beaker glass containing 10°C cold water for 15 minutes. The samples were then removed from the plastic bag and dried with filter paper for reweighing. Cooking shrinkage was calculated using the formula:

$$Cl\,\% = \frac{initial\ weight\ sample - final\ weight\ sample}{initial\ weight\ sample}\ x\ 100\ \%$$

Water Holding Capacity (WHC)

The water binding capacity of meat was measured by placing a meat sample weighing 0.3 g between iron plates coated with scale paper. The meat sample was pressed on an iron plate to a pressure of 35 kg/m^2 for 5 minutes. The area formed was measured using paper (Ismanto *et al*, 2017). Water binding capacity was calculated using the following formula:

$$WHC = dt\ x\ 100\%$$

Information:

d = Meat area (cm)
t = Total area (cm)

Tenderness

This test used the same sample after the cooking loss test. The sample was formed using according to the hole model (cylinder) in a meat fibre breaker tool (CD-Shear Force). The meat sample was positioned in the hole with the direction parallel to the meat fibre, and then the tool lever was pulled down, cutting perpendicular to the meat fiber. The results of the pulling load were read on a scale with units of kilogram (kg). A lower value of meat breaking force indicates greater meat tenderness while higher breaking force values indicate harder meat quality (Abustam, 2004).

Data Analysis

Data on physical properties obtained were analysed using variance analysis. If there was a significant difference (P ,0.05) between treatments, the analysis was continued with the Honest Differential Test (BNJ) (Steel and Torrie, 1993).

RESULTS AND DISCUSSION

The results of physical quality measurement of culled layer meat with Patikala (*Etlingera elatior*) fruit extract marination for each treatment is presented in Table 1.

The study's finding on spent layer meat soaked with Patikala fruit extract and its impact on the physical quality, including pH, cooking loss, water holding capacity, and tenderness of the meat are detailed below:

pH value

The analysis of variance results showed that soaking the meat of spent layer using different concentrations of patikala fruit extract

(*Etlingera elatior*) significantly affected ($p < 0.01$) the pH value. This was indicated by a decrease in pH value from 6.52 to 5.98. The decrease in pH value is close to the normal pH range of meat, which is 5.5. The degree of acidity decreased as the concentration level of patikala fruit extract increased. The highest pH value was observed in the T0 treatment (6.52), and the lowest pH value was found in the T3 treatment (5.68). However, at a certain level, there was an increase in pH value again when the meat was soaked with a 100% concentration of patikala fruit extract. A concentration of 100% hinders the optimal penetration of acid compounds contained in the extract by osmosis into the meat tissue. Conversely, a decrease in pH value close to the normal range can occur at a low solution concentration, because it facilitates the passage of acid compounds through a semi-permeable membrane and leads to increased acid penetration into the meat tissue. The acid content in the meat affects the rate of post-mortem glycolysis, causing a continuous decrease in pH due to acid hydrolysis. This aligns with the findings of a research by Hilmiati et al. (2016), that marinating native chicken meat in acetic acid for 15 minutes, with a concentration up to 12% can reduce pH, reduce the bacterial count, and extend the shelf life of meat.

The results of the Honest Real Difference Test (BNJ) show significant differences in pH values among different concentrations of patikala fruit extract. The pH of meat treated with 75% (T3) concentration of patikala fruit extract was not significantly different from the treatment with 100% (T4) concentration. Both treatments yield pH values that tend to fall within the normal range of 5.54 - 5.67. This aligns with the statement by (Abrar, 2020) that good meat is characterized by a normal pH value, and the pH of spent laying hen's meat after cutting reaches a final pH of 5.4 - 5.6.

The acidity of meat soaked in a 75% concentration (T3) of patikala fruit extract was significantly lower than meat soaked in 50% (T2) and 25% concentration (T1) of patikala fruit extract. This implies that patikala fruit extract at certain concentrations is effective in reducing the acidity level in meat (pH). This is due to the acidic compound components contained in patikala fruit extract that are able to optimally decrease the pH value. A research by Nurwantoro et al. (2012) showed that soaking beef in a solution of 31% orange juice, 31% lemon juice, and 38% distilled water could reduce the meat's pH value from 5.7 to 3.1; while also improving the tenderness of the meat from 178 N/cm^2 to 44 N/cm^2. Soaking in the acid system can be done for 6 - 24 hours. Protease can be added to shorten the process since acid and protease can cut peptide bonds in meat fibre proteins. Physical treatments that can accelerate the penetration of marinade ingredients are puncturing, size reduction, or tumbling system, involving mechanical agitation to break the meat fibres (Samsir, 2010).

Cooking Loss

Cooking loss is an indicator of the nutritional value of meat. It quantifies the meat juice or the amount of water retained within and between muscle fibres during the cooking process. The results of cooking loss value measurement of spent layer hen meat for each treatment are presented in Figure 2.

The average value of cooking loss value of overcooked laying chicken meat soaked with patikala fruit extract (*Etlingera elatior*) was highest in treatment T1 (36%) and lowest in T4 (10.48%). The analysis of variance results (Appendix 2) indicated that each treatment significantly affected ($p < 0.01$) the cooking loss of spent layer hen's meat. The observed cooking loss value of meat with patikala fruit extract immersion treatment fell within the normal range of 10.48% to 36%. As noted by Silaban et al. (2021), cooking shrinkage can vary between 1.5% and 54.5%, and meat with low cooking shrinkage has better quality due to the less nutrient loss during boiling.

The Honest Differential Test (BNJ) results showed varying cooking loss between treatments. Soaking meat with a 100% concentration of patikala fruit extract (T4) significantly differed from the 75% (T3) and 25% (T1) concentrations. The treatment with 50% concentration (T2) significantly differed from the T4 treatment. This suggests that soaking meat with a high concentration of patikala fruit extract results in a smaller shrinkage value. This can be attributed to the acidic compounds in patikala fruit extract, which holds water in the chicken meat during soaking, allowing for minimal water release during boiling. Therefore, this binding of water by meat protein results in a lower cooking loss. Patriani et al. (2020) explained that cooking loss reflects the percentage of weight loss in meat during the boiling process, which results in the high value of meat cooking loss and indicates reduced or lost meat nutrients during the boiling process.

Water Holding Capacity

Water holding capacity (WHC) is the ability of meat to bind water during external influences, such as meat cutting, heating, and grinding, and its ability to absorb water spontaneously from the surrounding environment (water absorption pressure or capacity). The measured water holding capacity values for chicken meat in each treatment are illustrated in Figure 3.

The average water binding capacity was highest in the T3 treatment (1.3) and lowest in T1 (0.66). Analysis of variance indicated that soaking spent layer meat in patikala fruit extract with different concentrations did not significantly affect ($P < 0.05$) the water holding capacity. Despite no significant effects, the average water holding capacity values in each treatment showed a decreasing water holding capacity at the 75% concentration limits. In treatment T1, the water binding capacity was 0.66, T2 was 1.17, T3 was 1.3, and T4 was 1.28. This trend suggests that chicken meat soaked with patikala fruit extract at 75% concentration displayed higher ability to bind water. This increase may be caused by the absorption of proteins contained in patikala fruit extract into the meat, resulting in increased meat protein content. The proteins form a complex network during the soaking, causing an increase in the water retaining ability. High water binding capacity is associated with better meat quality (Simbolon, 2018), as it reduces exudation or the release of fluids, such as proteins and amino acids, commonly known as weep, which occurs in raw, unfrozen meat or during cooking and reheating (Adinata *et al*., 2019).

Tenderness

The tenderness values of spent layer meat from each treatment are presented in Figure 4. The average tenderness was highest in the T0 treatment (3.45) and the lowest in T3 (2.08). Statistical analysis showed that soaking spent layer hens' meat in patikala fruit extract did not have a significant effect ($p < 0.05$) on its tenderness. Although not statistically significant, there was a tendency for the average tenderness value. In the T1 treatment, the tenderization value was 2.85, T2 was 2.68, T3 was 2.08, and T4 was 3.2. The average meat tenderness value suggests that spent layer meat soaked with patikala fruit extract at a 75% concentration has better tenderness, as indicated by a lower meat breaking force.

A meat will be considered tender if the soaking value is low, indicating good quality. On the contrary, high meat tenderness value suggests tougher meat that is difficult to chew. This aligns with the opinion of Jahidin (2016) that a decrease in the breaking value of meat will show improved tenderness. The criteria for meat tenderness are categorized as follows: very tender (Warner Blatzer breaking strength <4.15 kg/cm$^{2)}$, tender (4.15 - <5.86 kg/cm$^{2)}$, slightly tender (5.86 - <7.56 kg/cm$^{2)}$, slightly tough (7.56 - <9.27 kg/cm^2), tough (9.27 - <10.97 kg/cm^2), and very tough (>10.97) (Komariah *et al*., 2012).

Table 1. Mean values of pH, Cooking Loss, Water Holding Capacity and Tenderness Spent Layer Meat with Patikala (*Etlingara elatior*) Fruit Extract Soaking.

Parameter	Treatment				
	T0 (0%)	T1 (25%)	T2 (50%)	T3 (75%)	T4 (100%)
pH	6.52	5.98	5.83	5.68	5.72
Cooking Loss	32.35	36.00	15.15	29.85	10.48
Water Holding Capacity	1.26	0.66	1.17	1.3	1.28
Tenderness	3.45	2.85	2.68	2.08	3,2

Description: T0 = Meat Without Patikala Fruit Extract Soaking; T1 = Meat Soaking Using 25% Patikala Fruit Extract; T2 = Meat Soaking Using 50% Patikala Fruit Extract; Meat Soaking Using 75% Patikala Fruit Extract; Meat Soaking Using 100% Patikala Fruit Extract.

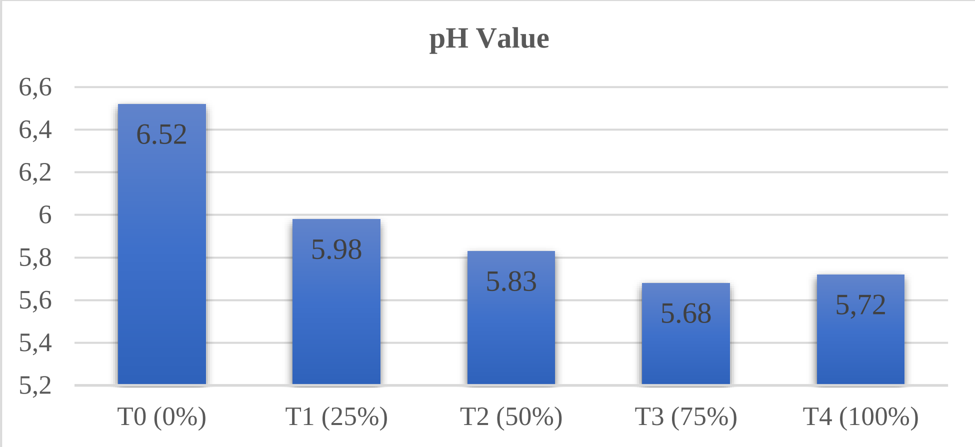

Figure 1. The acidity (pH) value of spent layer meat marinated with patikala fruit extract at different concentrations.

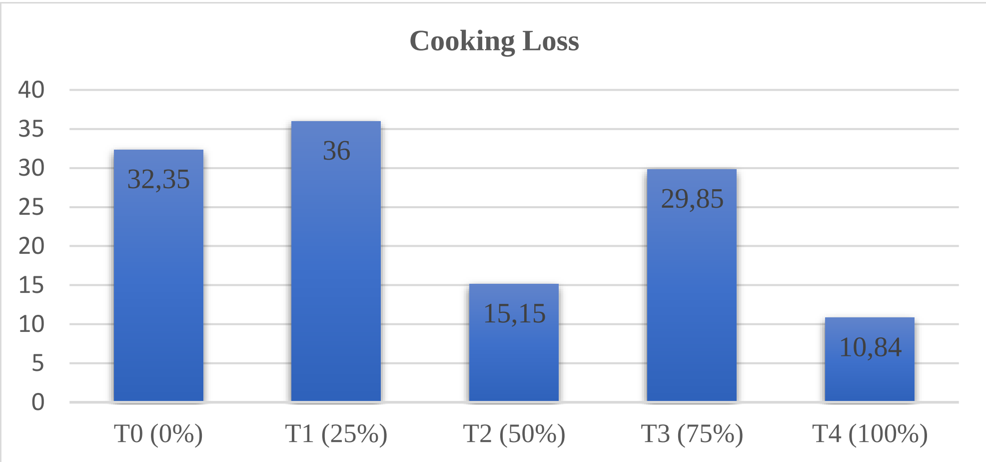

Figure 2. Cooking Loss Value of Spent Layer Hen's Meat from Each Treatment

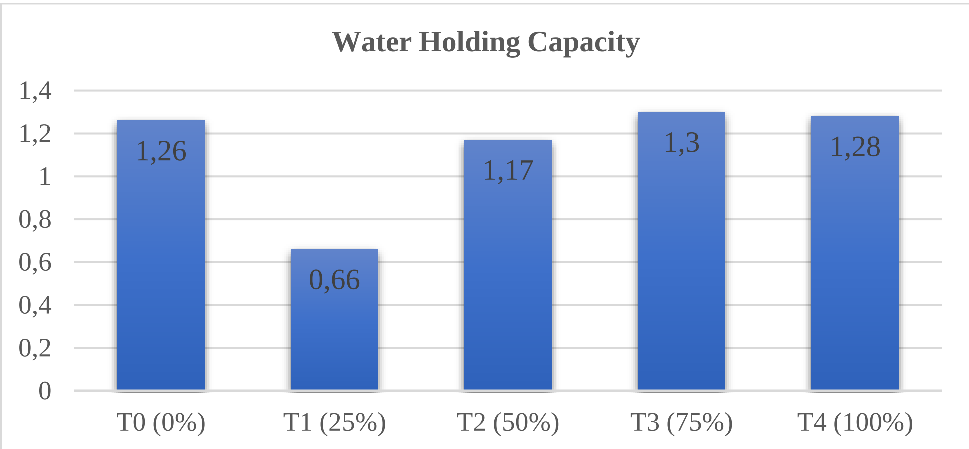

Figure 3. Water Holding Capacity Value of Spent Layer's Meat from Each Treatment

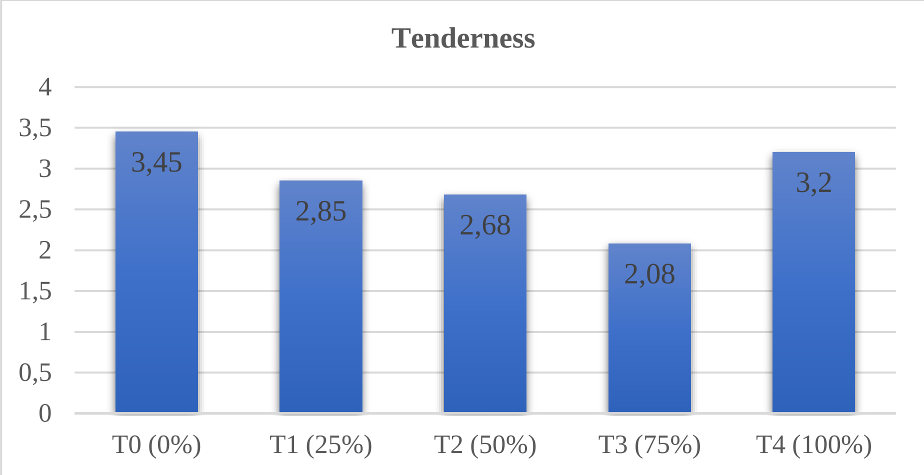

Figure 4. Tenderness Value of Spent Layer Chicken's Meat from Each Treatment

CONCLUSIONS

Based on the results of the study, it can be concluded that soaking spent layer meat in Patikala fruit extract can improve its physical quality, particularly in reducing the meat's degree of acidity (pH) and cooking loss. However, it did not yield significant improvement in the meat's water holding capacity and tenderness.

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