The effect of *Garcinia atroviridis* extract on water content, pH and cooking loss value of rejected laying hens meat

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**Abstract.** *Garcinia atroviridis* or by Indonesian name is *Asam Gelugur* (tamarind) is often used as a spice for cooking in Indonesia. *Garcinia* fruit contains minerals, vitamins, fibre, flavonoids, hydroxy citric, ascorbic, malic, tartaric, and also other ingredients that are useful for health and cause a decrease in the quality of meat. The purpose of this research was to explain the effect of *Garcinia* extract on water content, pH, and cooking loss values of rejected laying hens. The study used a completely randomized design (CRD) with 4 treatments and 5 replications. The treatment was given to the rejected laying hens meat that were marinated in *Garcinia* extract levels that are 0% (P0), 2% (P1), 4% (P2) and 6% (P3) for 15 minutes and then stored for 48 hours at room temperature 27°C to 30°C. Based on the analysis of variance and test results with DMRT showed that using *Garcinia* extract at all levels had a highly significant different (P<0.01) of the water content, pH and cooking losses of rejected laying hens meat. *Garcinia atroviridis* at 4% level effectively maintains the quality of meat during storage for up to 48 hours because it produces the normal water content, pH and reduces cooking loss.

1. **Introduction**

Rejected laying hens ‘meat is sold and bought in traditional markets, especially in the city of Medan. This type of meat is also one of the animal protein commodities that can be a source of nutrition for the community. Refined rejected laying hens are poultry meat that has decreased productivity but can still be used as a food. Nutritional content such as protein and chicken meat fat of rejected laying hens is a suitable medium for microbial growth because of this. Therefore, good handling needs to be done to prevent damage to the meat. Besides that, is, the physical quality of rejected laying hens is known as taste which is tough and less liked is a problem that needs to be overcome to be able to increase the consumption of animal protein.

One method that can be used to prevent damage and improve the quality of rejected laying hens is marination using cheap and easily available natural ingredients such as *Garcinia atroviridis*. *Garcinia atroviridis* or by Indonesian name is Asam gelugur is an acid-producing plant that is widespread in Indonesia and is generally often used as a cooking spice, especially by the Malay and Acehnese people. *Garcinia* contains antioxidants, anti-microbial compounds, saponins, and flavonoids which are useful as anti-microbial, as well as tannins and citric acid which are useful for preventing pathogenic bacteria that cause rot. Mackeen, *et. al.* [1] examined the bioactivity of the aqueous ethanol extract of this plant which gave the result that the extract had antibacterial,
antifungal, antioxidant, anti-tumour, and antimalarial activity. Apart from this, the acidic properties of the fruit such as citric acid are thought to improve the physical quality of tough chicken meat.

So far, the use of Garcinia as a food preservative is less known to the public at large but its utilization as a natural preservative is not particularly new to preserving meat in several areas so that they can be used as a prospect for development promising. The value of water content, acidity (pH), and cooking losses are physical properties that affect the quality of the meat, so it is necessary to know the changes in these physical properties after the livestock is slaughtered. Therefore, this study aims to determine the physical changes of rejected laying chicken meat by marinating with Garcinia extract within 48 hours of storage.

2. Materials and methods

2.1. Materials and tools
The material used was the rejected laying hen’s meat weighing 10-15 g/slice which is marinated within the level of Garcinia extract according to treatment for 15 minutes and then stored for 48 hours in 27°C to 30°C and ethanol for maceration process. The tools used is a set of maceration tools.

2.2. Research methods
The research used was an experimental design with a Complete Randomized Design (CRD) consisting of 4 treatments and 5 replications. If the F count > F table, the analysis will be continued using Duncan’s test. The meat in this research is given the following treatments:

- P0 = rejected laying hens meat marinated with 0% Garcinia extract
- P1 = rejected laying hens meat marinated with 3% Garcinia extract
- P2 = rejected laying hens meat marinated with 6% Garcinia extract
- P3 = rejected laying hens meat marinated with 9% Garcinia extract

2.3. Research parameters
Test parameters and methods are as follows:

- Water content of meat. The water content can be calculated using the method of Air-oven drying that is very convenient, and is one of the most widely and commonly used methods for routine moisture determination in laboratories around the world [2,3] or using the moisture meter meat.
- pH of meat. Meat pH measurement on this research can use a pH meter [4].
- Cooking loss. Cooking loss measurement on rejected laying hen’s meat sample done using the CSIRO method [5].

2.4. Extraction of fresh Garcinia atroviridis
The ripe Garcinia fruit is thinly sliced and dried in the oven and then broken down using a hammer and mashed using a grinder. After obtaining the Garcinia powder then extracted by maceration [6]. Maceration results from 100-gram Garcinia powder in 1 litres of 70% ethanol in the form of the yellow filtrate. After evaporating, a thick extract was obtained and then centrifuged, filtered and dried in an oven at 60°C for three days in the resulting extract is brown.

3. Results and discussion

3.1. Water content of meat
The water content of rejected laying hen’s meat in this study is presented in Table 1. Based on the analysis of variance, it showed that the giving of Garcinia extract had a highly significant effect (P<0.1) on the water content of rejected layer hen’s meat. The water content obtained from the treatment were respectively 69.30% (P0), 75.16% (P1), 72.46% (P2), and 76.70% (P3). The value of water content in this study was initially influenced by the water content of chicken meat at the time of slaughter, namely 66.8-71.4% with an average of 69.30%. The water content is still at the normal level, namely the water content in chicken meat is 65-80% [7].
The results of this research with effect of *Garcinia extract* on the water content, pH, and cooking loss value are as follows:

| Treatment | Water content (%) | Average value of | Cooking loss (%) |
|-----------|-------------------|-----------------|------------------|
| P0        | 69.30 ± 3.19<sup>D</sup> | 5.98 ± 0.005<sup>A</sup> | 27.53 ± 0.42<sup>A</sup> |
| P1        | 75.16 ± 0.65<sup>B</sup> | 5.69 ± 0.001<sup>B</sup> | 25.87 ± 1.81<sup>B</sup> |
| P2        | 72.46 ± 3.32<sup>C</sup> | 5.66 ± 0.002<sup>B</sup> | 22.61 ± 0.23<sup>C</sup> |
| P3        | 76.70 ± 1.98<sup>A</sup> | 5.56 ± 0.001<sup>C</sup> | 23.08 ± 1.88<sup>C</sup> |

Note: A, B, C, D = Different notation on the same column that show highly significant effect at the 1% level according to the DMRT test.

The results of the DMRT analysis showed that the water content of rejected laying hen’s meat at each level was highly significant different (P<0.01) from the highest value on the water content with 6% of Garcinia extract (P3). The results showed that the water content in the study was influenced by the water content of the two basic ingredients that are chicken meat and *Garcinia extract* so that the addition of Garcinia extract at the level of 2%, 4%, and 6% could significantly increase the moisture content of the meat. This is presumably because during storage the chicken meat has adjusted to its environment

The water content of untreated meat (P0) showed the lowest very significant results. This is because during the storage process evaporation occurs in the meat to achieve water equilibrium. This evaporation occurs because the steam pressure in the meat is not the same as the vapor pressure around it. Evaporation will continue as long as water equilibrium is reached, when the steam pressure in the chicken meat is the same as the steam pressure of the surrounding environment [8]. This does not happen optimally in meat that has been soaked with Garcinia’s solution. The presence of acid and ethanol in the *Garcinia extract* can inhibit the evaporation of water so that the water content of the meat soaked with *Garcinia extract* is significantly higher than the control

### 3.2. pH value of meat

**pH** value of rejected laying hen’s meat in this study presented in Table 1. The results of the analysis showed that the addition of Garcinia extract had a highly significant effect on the **pH** value of the rejected laying hen’s meat. The **pH** levels obtained from the treatment were respectively 5.98 (P0), 5.69 (P1), 5.66 (P2), and 5.56 (P3). The **pH** value is one of the criteria for the physical characteristics of the meat. After post-mortem, the **pH** value will decrease. The **pH** value is used to indicate the level of acidity and alkalinity of a substance. The **pH** value of muscle when live animal is around 7.0-7.2 (neutral **pH**). After the animal are slaughtered (post-mortem) the **pH** value in the muscles (**pH** of the meat) will decrease due to the accumulation of lactic acid. Decrease in the **pH** value of animal muscles properly handled before slaughter will progress gradually from 7.0 to 5.6-5.7 within 6-8 hours post-mortem and will reach a final **pH** value of about 5.5-5.6 [9] and the **pH** of the meat from this study is still in the normal **pH** range of meat in post mortem conditions. It is in line with Margarida’s research that the use of *Garcinia atroviridis* solution can decrease the **pH** in broiler chicken meat and can inhibit spoilage in the meat [10].

The average **pH** value in this study was in line with the addition of the Garcinia extract level. The higher level of Garcinia extract was giving the high significantly different (P <0.01) to decreased the **pH** of the rejected laying hen meat. The DMRT test results showed that the use of 2% Garcinia extract (P1) resulted in a **pH** equal to 4% (P2) but very significantly different (P <0.01) with a level of 6% (P3) and control (P0). *Garcinia atroviridis* contains organic acids in the form of citric acid of 10.6 mg/g; malic acid of 28 mg/g, tartaric acid of 35 mg/g, and ascorbic acid of 51 mg/g so the Garcinia extract solution has **pH** a range from 4 to 7 [11].
The decrease in the pH value is caused by the presence of ascorbic acid compounds contained in Garcinia extract which seep into the meat through the osmosis process. The decrease in the pH value increases the shelf life of this meat. This is consistent with the statement of [12] that the shelf life of chicken meat can be extended through the addition of organic acids. The decrease in pH value is caused by the release of H+ ions by the acid compounds contained in the Garcinia extract. This is consistent with the statement of [13] that the H+ ion released will cause the pH value to be lower. Furthermore, it is said that the phenolic compounds contained in Garcinia play an important role in donating H+ ions so that the more H+ ions are produced, the lower the pH value will be.

3.3. Cooking loss
Cooking loss value can describe the weight lost during cooking, the higher cooking temperature and/or the length of the cooking time, the greater loss of liquid until it reaches a constant level. Cooking loss is an indicator of nutritional value related to the level of meat juice, amount of air that is connected in and between muscle fibres [5]. The results of the analysis showed that Garcinia extract giving had a highly significant different (P<0.01) in reducing the cooking loss value of rejected laying hen’s meat. The value of cooking losses was between 22.61-27.53% (Table 1). The results obtained belong to the normal range. According to [5], the cooking loss value of meat is between 1.5-54.5% with a range of 15-40%

The results of DMRT showed that the cooking loss value with the using of Garcinia extract at 4-6% levels was highly significant different lower (22.61-23.08%) compared to the 2% level (P1) and control (P0). Meats with lower cooking losses have relatively better quality than larger meats because they will lose fewer nutrients during cooking

A decrease in cooking loss value caused by a decrease in pH of post-mortem meat which resulted in a lot of damaged myofibril protein, thus losing the ability of the protein to bind water, which in turn increased cooking loss. Some of the factors that affect the value of meat cooking loss are water holding capacity (DIA), pH, myofibril contraction status, length of muscle fibre sarcomere, size and size of meat [5,13]. This different cooking loss value is in line with the different moisture content of the meat in each treatment. Cooking losses are greatly influenced by the amount of water lost during cooking. One of the factors that causes it is meat protein which can bind water; thus, the more water is retained by meat protein, the less water will be released and results in lower cooking losses

4. Conclusions
The results of this study showed that the use of Garcinia atroviridis extract had a highly significant effect (P<0.01) on water content, pH, and cooking loss of rejected laying hen’s meat. In conclusion that the use of Garcinia extract at 4% level effective for maintaining the quality of rejected laying hen’s meat during storage for up to 48 hours because it produces the normal water content, pH and reduces cooking loss.

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