The Effect of a Marinating Process Containing Extract Formulations of Pineapple Waste, Papaya Leaves, and Noni Fruit on the Quality of Culled Laying Hens

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Abstract
The purpose of the research is to evaluate the physical quality (pH and cooking loss), organoleptic tests, and *Salmonella sp.* bacteria content of marination formulations of pineapple waste extract (ELN), papaya leaf extract (EDP), and noni fruit extract (EBM) discarded laying hens. There were 12 culled laying hens used. P0: Control (no extract); P1: 15% Extract (5% ELN +5% EDP +5% EBM); P2: 22.5% Extract (7.5% ELN + 7.5% EDP + 7.5% EBM); and P3: 30% Extract (10% ELN + 10% EDP + 10% EBM) and meat from rejected layers soaked for 30 minutes. The obtained data were analyzed using the ANOVA test, and if the results were significantly different, the Duncan test was used. Organoleptic tests were performed by 29 panelists, 25 of whom were semi-trained and four of whom were untrained. The results showed that the color and tenderness of the rejected laying hens' meat had a significant effect, but the aroma and taste had no effect. P3 with a combination treatment of 30% extract (10% pineapple peel and hull extract + 10% papaya leaf extract + 10% noni fruit extract) noni was the most preferred treatment by all panelists, with neutral organoleptic values for color, aroma, and taste of 2.62 on a scale of 2.10-3.00, and organoleptic values for softness of 3.31 on a scale of 3.00-4.00.

Keywords: *Aroma, Marination, Organoleptic, Tenderness*

1. Introduction

The rapid development of food products, especially those derived from the livestock sector, is inseparable from innovative knowledge about the functional properties of food components that are seen when these components interact with each other in a multi-component food system (Komansilan, 2015). For example, spent laying hens have a weakness in the texture of their meat, causing low consumer demand. The age of spent laying hens varies between 18 and 20 months, resulting in tough meat texture. The tough texture of spent laying hen meat results in low sales value, so it is rarely consumed (Ismanto and Basuki, 2017). Therefore, a method is needed to improve the tenderness of spent laying hen meat (Biyatmoko *et al.*, 2018).

One of the treatments that can be done to improve the quality of spent laying hen meat is through marination using natural ingredients that enhance meat tenderness and reduce cooking loss. The marination process uses the acidic properties of natural passion fruit juice to change the pH of the meat, resulting in good water binding capacity, cooking loss, and meat tenderness

(Kamila *et al.*, 2015). Additionally, the soaking process can extend the shelf life of the meat with guava extract (Haikal *et al.*, 2021).

The marination process uses natural ingredients that are relatively cheap and easy to obtain, such as fruit extracts or by-products of pineapple and papaya, as well as noni fruit extract, which is known to contain enzymes that can tenderize meat. The enzymes contained in papaya is papain and chymopapain, which are protease enzymes capable of hydrolyzing meat protein. Pineapple also contains bromelain, which is a proteolytic enzyme. The protease enzyme found in noni fruit extract can be used to tenderize meat, just like pineapple and papaya (Ismanto and Basuki, 2017; Rismawati *et al.*, 2016).

In an effort to demonstrate the novelty of this research compared to previous studies, the researchers attempted to compare the effects of the third formulation of a mixed extract from pineapple waste, papaya leaves, and noni fruit extract at various concentration levels on the quality of spent laying hen meat. The use of a combination of pineapple waste, papaya leaves, and noni fruit extract on chicken meat was tested organoleptically in terms of, color, aroma, taste and tenderness, and was followed by testing for *Salmonella* sp bacteria at each extract concentration level, which had never been done in the process of marinating spent laying hen meat. Therefore, this research was conducted to evaluate the effect of marination on spent laying hen meat using a combination formulation of pineapple waste extract (ELN), papaya leaf extract (EDP), and noni fruit extract (EBM) on pH, cooking loss, organoleptic properties to determine the extract formulation that is preferred by the community, and then followed by testing for *Salmonella* sp bacteria.

2. Research Method

The research utilized a completely randomized design (CRD) with a factorial pattern based on modifications from Falahudin (2022), Supiatun (2018), and Rismawati *et al.* (2016). The independent variables in this study were the formulations of pineapple waste extract (ELN), papaya leaf extract (EDP), and noni fruit extract (EBM) at concentrations of 15%, 22.5%, and 30% for testing pH, cooking loss, organoleptic properties, and Salmonella sp bacteria. Each treatment in the testing was repeated three times, resulting in a total of 12 experimental units. Each treatment was also subjected to organoleptic testing based on color, aroma, and consistency parameters. The data from each test were processed using analysis of variance (ANOVA) with a significance level of 5%. If the treatment had a significant effect, further testing would be conducted using Duncan's test with IBM SPSS Statistics 27 for Windows. The various treatments applied to the meat with different concentrations of each extract, along with soaking and incubation for 30 minutes in each treatment, were described as follows:

P0: Control (without extract)
P1: 15% Extract (5% ELN + 5% EDP + 5% EBM)
P2: 22.5% Extract (7.5% ELN + 7.5% EDP + 7.5% EBM)
P3: 30% Extract (10% ELN + 10% EDP + 10% EBM)

Organoleptic Quality (Usman et al., 2022)

Organoleptic quality is a term used to describe the sensory qualities of food, water, or other substances an individual experiences through their senses. Organoleptic quality refers to the sensory qualities of meat, including color, aroma, taste, and tenderness. The testing of organoleptic quality involves trained panelists who evaluate the meat based on a scoring system. For color, the scores range from 1 (very unappealing) to 5 (very appealing). For aroma, the scores range from 1 (very unpleasant) to 5 (very pleasant). For taste, the scores range from 1 (very bland) to 5 (very flavorful). For tenderness, the scores range from 1 (not tender) to 5 (very tender). The panelists used in the study were trained and consisted of 29 panelists, 25 of whom were semi-trained and four of whom were untrained.

3. Results and Discussions

Organoleptic Test

The average scores for the color of culled laying hen meat in the study are presented in Table 1 below.

Table 1. The average color scores of the meat of culled laying hens at each soaking concentration

Soaking Concentrations	Scores
P0	3.00^{b}
P1	$2,62^{ab}$
P2	$2,41^{a}$
P3	$2,62^{ab}$

The superscript numbers in the same column indicate significant differences at a confidence level of 95% ($p<0.05$)

The analysis conducted by Duncan on the concentration of culled layer chicken meat showed a significant effect ($p<0.05$). The lowest average value of meat color for culled layer chicken was 2.41, which was achieved in treatment P2, while the highest value was achieved in treatment P0, which was 3.00. The given statement indicates the following: Treatments P1, P2, and P3 do not differ significantly ($P>0.05$); Treatments P0, P1, and P3 do not differ significantly ($P>0.05$); However, treatments P0 and P2 differ significantly ($P<0.05$). Various factors, including the type of myoglobin molecule, chemical status, and physical and chemical conditions of the components in meat, determine the color of meat. Myoglobin is the iron-rich protein that gives

meat its color and stores oxygen in muscle cells. The more myoglobin content meat contains, the darker red it will appear in color. Oxidation of myoglobin can lead to changes in meat color, and myoglobin can undergo shape changes due to various chemical reactions when exposed to air (Ismanto and Basuki, 2017). The handling and storage of chicken meat also contributes to determining the resulting meat color. Environmental factors during slaughter, pre-slaughter conditions, cutting conditions, and storage can influence the color of poultry meat. These factors can, directly and indirectly, influence the component traits of meat color, and they should be controlled during the designing and reporting of meat color research. The literature documents that many factors affect meat color, and muscle metabolism and meat color are interrelated (Hajrawati *et al.*, 2016).

The average scores for the aroma of culled laying hen meat from the research study are presented in Table 2 below.

Table 2. The average aroma scores of the meat of culled laying hens at each soaking concentration

Soaking Concentrations	Scores
P0	2,82[a]
P1	2,72[a]
P2	2,69[a]
P3	2,62[a]

The superscript numbers in the same column indicate significant differences at a confidence level of 95% ($p<0.05$)

Based on the analysis conducted by Duncan on the concentration of culled layer chicken meat, it was found that there was no significant effect ($p>0.05$). The lowest average value of meat aroma for culled layer chicken was 2.62, which was observed in treatment P3, while the highest value was achieved in treatment P0, which was 2.83. This indicates that all the treatments, including P0, P1, P2, and P3, did not show significant differences ($P>0.05$). This is consistent with the research conducted by Rismawati *et al.* (2016), which found that the use of various concentrations of noni fruit extract as a marinade for culled free-range chicken meat did not have a significant effect ($P>0.05$) on the aroma of the meat.

The average scores for the taste of culled laying hen meat from the research study are presented in Table 3 below.

Table 3. The average taste scores of the meat of culled laying hens at each soaking concentration

Soaking Concentrations	Scores
P0	2,34[a]
P1	2,41[a]
P2	2,17[a]
P3	2,62[a]

The superscript numbers in the same column indicate significant differences at a confidence level of 95% (p<0.05)

Based on the analysis conducted by Duncan on the concentration of culled layer chicken meat, it was found that there was no significant effect (p>0.05). The lowest average value of meat taste for culled layer chicken was 2.17, which was observed in treatment P2, while the highest value was achieved in treatment P3, which was 2.62. This indicates that all the treatments, including P0, P1, P2, and P3, did not show significant differences (P>0.05). According to Biyatmoko *et al*. (2018), the duration of marination will affect the taste, making the chicken meat delicious. The addition of pineapple extract will break down amino acids, so with longer marination, a delicious taste will emerge in culled-layer chicken meat. The statement contradicts the findings of Dewanto *et al*. (2017), which showed that the longer the soaking of culled laying hen meat in pineapple skin extract, the lower the preference for the taste of old laying hen meat due to the astringent taste of the meat. The astringent taste is caused by tannins contained in pineapple skin. Soaking in pineapple skin extract can hydrolyze polypeptides in lipoproteins, causing fats and other substances to be released.

The average scores for the tenderness of culled laying hen meat from the research study are presented in Table 4 below.

Table 4. The average tenderness scores of the meat of culled laying hens at each soaking concentration

Soaking Concentrations	Scores
P0	2,21[a]
P1	2,66[ab]
P2	2,79[b]
P3	3.31[c]

The superscript numbers in the same column indicate significant differences at a confidence level of 95% (p<0.05)

The analysis conducted by Duncan on the concentration of culled layer chicken meat showed a significant effect (p<0.05). The higher the concentration of the combination extract, the more it will increase the tenderness of culled laying hen meat. There is no significant difference

between P0 and P1, and there is no significant difference between P1 and P2, but P0 is significantly different from P2 and P3, and P2 is significantly different from P3. This is in line with the research conducted by Utomo *et al*. *(*2017) that bromelain, protease, and papain enzymes contained in pineapple, noni, and papaya fruit extracts significantly affect the changes in the tenderness level of culled laying hen meat. The more protease enzymes used, the more connective tissue proteins are hydrolyzed. During this process, collagen and myofibrils are hydrolyzed, causing the loss of binding between meat fibers and the breakdown of shorter fiber fragments, thus increasing the tenderness of the meat.

4. Conclusions

The study examined the effects of marination formulations of pineapple waste extract (ELN), papaya leaf extract (EDP), and noni fruit extract (EBM) on the meat of discarded laying hens. The results showed that the color and tenderness of the meat were significantly affected by the marination formulations, but the aroma and taste had no effect. Treatment of 30% extract (10% pineapple peel and hull extract + 10% papaya leaf extract + 10% noni fruit extract) noni was the most preferred treatment by all panelists.

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