The effect from different level of Melinjo (Gnetum gnemon Linn) leaf extract and storage duration on the quality of duck eggs

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Abstract. Eggs are one of perishable food products and a very short shelf life. If the eggs are left in the opened air (room temperature), it is lasting only for about 10-14 days. After these days, the eggs undergo alteration of the damage such as evaporation of water content, foul smelling and changing taste. Efforts to overcome the damage, it is necessary to perform preservation. Preservation can be done by marinating. Marinating eggs can be conducted by soaking with various solutions such as lime water or vegetable tanners containing tannins. Melinjo leaves contain high levels of tannins 4.55% which are expected to be one of the vegetable tanning materials. The experiment was conducted in the Laboratory of Animal Technology. This study was used 176 duck eggs that were arranged using completely randomized design (CRD) of factorial pattern 4 x 4 with 3 replications, and consisting of 2 factors. The first factor was the levels of melinjo extract ( 0%, 30%, 40% and 50% ) and the second factor was storage duration (1, 14, 21 and 28 days, respectively). The results of this study showed that higher levels of leaf melinjo extract, the Haugh unit (HU) value was increased and the depth of the air cavity was decreased. The longer of the storage duration, the lower of HU value of yolk index. On the other hand, the depth of air cavity, depreciation, were increased. In brief, Melinjo leaf extract (30%) can be used as a preservative of duck eggs.

1. Introduction

The Egg is one of the perishable food products and has a very short shelf life. If left in the opened air (room temperature) only last 10–14 days, after that time the eggs undergo changes in the direction of damage such as the evaporation of water content, foul odor and change in taste [1]. The effort to overcome the damage it is necessary to hold preservation [2]. Preservation is done so that the nutritional value remains high, does not change the taste, does not smell bad and the color does not fade. Preservation can be done by drying, covering the skin with preservatives, storage in a cooling room and soaking. Soaking fresh eggs is done by soaking various solutions such as lime water, saline and filtrate solutions or vegetable tanners containing tannin [3]. Plants that contain tannins are melinjo. The chemical content of melinjo (Gnetum gnemon L.), especially in seeds and leaves, among others contains saponins, flavonoids and tannins [4].

Melinjo plants contain a polyphenol component called resveratrol. Resveratrol has antibacterial and antioxidant properties. The results of proximate analysis of melinjo leaf contain tannin concentration
around 4.55% which is expected to be one of the plant tanners [5]. A number of phenolic groups derived from tannins play a role in forming hydrogen bonds with proteins [6]. The results of research on preserving broiler eggs by soaking the melinjo leaf extract 20 or 30% can improve the external and internal quality of broiler eggs. Another study reported that 24-hour immersion can maintain the quality and storability of eggs [3]. Therefore in this study we will study more deeply the use of melinjo (Gnetum gnemon L.) leaves as an alternative to preserving duck eggs so as to produce eggs that can last longer.

2. Materials and methods

The materials used in this study were melinjo leaves, fresh duck eggs, water, roll tissue, label paper, distilled water, buffer pH 4 and pH 7. The research was conducted according to a completely randomized design (CRD) with factorial pattern (4x4). The first factor was the level of melinjo leaf extract (0, 30, 40, 50%, respectively), and the second factor was the duration of storage (1, 14, 21 and 28 days, respectively). Each treatment was replicated three times.

2.1 Research and procedure

Melinjo leaves used in this study were young melinjo leaves where the highest tannin content was found in young leaves [7]. Small sliced melinjo leaves were dried first before boiling. The concentration of melinjo leaves used in this study is the ratio of 0, 30, 40, and 50% (w/v), which was similar to 450, 600 and 750g of melinjo leaves. The next step was boiled the sliced melinjo leaves in 1.5 liters of water for 10 minutes [8]. The aims of the boiling process was to accelerate the dissolution of tannins into the water, so that the amount of tannin extract obtained were more than filter or cooling method [9].

A total of 176 fresh duck eggs (less than 24 hs) were used in the experiment. Each egg was cleaned and weighed, and then put in the container containing a solution of melinjo leaf extract. To avoid contamination and maximize the tannin reaction the container was closed [10]. Eggs were soaked in the solution for 24 hours, then air dried and placed on an egg tray. Storage condition was maintained at room temperature, observation and measurement of data were made at days 1, 14, 21 and 28. The parameters measured in this study were the depth of air cavity, haugh unit (HU) value and the yolk index value.

2.2. Data analysis

Data were analyzed according to the analyses of variance based on the general linear model procedure. The treatment which showed the effect was further tested by Duncan's method.

3. Result and discussion

3.1. Effect of melinjo leaf extract and storage duration on duck egg cavity

One quality factor that can provide clues to egg freshness is the state of the depth of the air cavity. The depth of the air cavity increased along with the prolonged storage duration at room temperature without any maintenance. The effects of melinjo leaf extract on the air cavity of duck eggs are presented in table 1.
Table 1. Average depth of duck egg air cavity (mm) with soaking of melinjo leaf extract and storage time.

| Melinjo Extract Level (%) | Storage Time (Day) | Average |
|---------------------------|--------------------|---------|
|                           | 1                  | 14      | 21     | 28     |
| 0                         | 3.46               | 7.69    | 10.21  | 10.66  | 8.00<sup>a</sup> |
| 30                        | 2.87               | 7.27    | 9.58   | 9.56   | 7.31<sup>bc</sup> |
| 40                        | 2.03               | 6.69    | 8.45   | 9.53   | 6.67<sup>ab</sup> |
| 50                        | 1.64               | 6.24    | 8.16   | 9.20   | 6.31<sup>a</sup> |
| Average                   | 2.50<sup>a</sup>   | 6.97<sup>b</sup> | 9.09<sup>b</sup> | 9.73<sup>c</sup> |

Different superscripts in the same row and column show very significant differences between treatments (P <0.01).

Melinjo leaf extract level and storage time of melinjo leaf had a significant effect on duck egg cavity. However, there was no interaction between melinjo leaf extract level and storage time. At the level of melinjo leaf extract shows the higher the level given, the lower the depth of the air cavity. The depth of the air cavity at each level of melinjo leaf extract shows the quality of quality II, which means the egg quality is still good. Storage duration indicates that the longer the storage, the greater the depth of the air cavity. The quality of the depth of the air cavity at 1 day showed Quality I, 14 days showed quality II, 21 and 28 days showed quality III which means the eggs were not good enough. The depth of the air bag quality I = <0.5cm, quality II = 0.5cm-0.9cm and quality III> 0.9cm [11].

Duncan's further test results showed the lower the level of melinjo leaf extract, the greater the depth of the air cavity. At the level of 0% to 40% and 50% and at the level of 30% to 50%, this is caused by a higher level of leaf extract. The more perfectly covered by the pores of the egg shell so that the evaporation of water and CO<sub>2</sub> gas from the egg can be inhibited. Coating treatment to close the pores of the shell so that the surface area where moving air can be obstructed [12].

Duncan's further test results showed the longer the storage the greater the depth of the air cavity. The longer the storage, the depth of the air cavity will increase due to loss of water and CO<sub>2</sub> gas that comes out through the pores of the egg. Eggs will experience a decrease in quality along with the length of storage, the longer the storage time will result in a lot of evaporation of liquid in the egg and cause a bigger air bag [1].

3.2. Effect of melinjo leaf extract and storage duration on duck egg Haugh Unit (HU)

Haugh Unit (HU) is a method which is used to determine the freshness level of an egg by measuring the thickness of the albumen [13]. Several causes of egg quality decline is the evaporation of CO<sub>2</sub> in the albumen due to prolonged storage, resulting in gas exchange from inside and outside the egg [1]. The effects of melinjo leaf extract on the haugh duck egg unit are presented in table 2.

Table 2. Average haugh value of duck egg unit with melinjo leaf extract immersion and storage duration.

| Melinjo Extract Level (%) | Storage Time (Day) | Average |
|---------------------------|--------------------|---------|
|                           | 1                  | 14      | 21     |
| 0                         | 90.95              | 81.96   | 78.14  | 76.66  | 81.93<sup>a</sup> |
| 30                        | 97.17              | 84.76   | 80.88  | 81.19  | 86.00<sup>ab</sup> |
| 40                        | 97.57              | 86.54   | 82.16  | 82.36  | 87.15<sup>b</sup> |
| 50                        | 95.10              | 88.16   | 84.25  | 83.86  | 87.84<sup>b</sup> |
| Average                   | 95.19<sup>c</sup>  | 85.35<sup>b</sup> | 81.35<sup>ab</sup> | 81.01<sup>a</sup> |

Different superscripts in the same row show very significant differences between treatments (P<0.01) and different superscripts in the same column show different between treatments (P<0.05).
Extract rate and storage time of melinjo leaves are very influential on the units of duck eggs. However, there was no interaction between the level of melinjo leaf extract and storage time. The average addition of melinjo leaf extract level shows that the higher the level of administration, the higher the HU value produced. The use of 0% melinjo leaf extract shows a HU value of 81.93 (AA quality), 30% HU value of 86.00 (AA quality), 40% HU value of 87.16 (AA quality) and 50% HU value of 87.84 (AA Quality). This shows that the egg quality is still high and still has a high ovomucin content. The higher the egg white, the higher the HU value obtained. Egg whites that contain fewer ovomucins will melt faster [14].

Duncan's further test results showed the higher the level of melinjo leaf extract, the higher the value of the duck egg haugh unit. The level of melinjo leaf extract affects the unit value of duck eggs haugh. The tanning material (tannin) contained in it closes the pores of the eggshell so that CO₂ gas can be inhibited and the thickness of the egg white is maintained. Prevention of evaporation of water and carbon dioxide (CO₂) gas will slow the increase in pH and the thickness of egg whites can be maintained [15].

Duncan's further test results showed the longer the storage, the smaller the unit value of duck eggs. This is because of the longer storage, the quality of the albumen (HU) will decrease due to evaporation of CO₂ from the egg, so the pH rises and damages the ovomucin as a result the egg white will become thinner. Ovomucin fiber in the form of mesh in the egg whites will be damaged due to increased pH of the egg whites due to loss of CO₂ so that the egg whites become runny [14].

3.3. Effect of melinjo leaf extract and storage duration on yolk duck eggs

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The yolk index stored at room temperature is a comparison between the height of the yolk and the diameter of the yolk measured after being separated from the egg whites. The effect of melinjo leaf extract on the haugh duck egg unit is presented in table 3.

| Melinjo Extract Level (%) | Storage Time (Days) | Average |
|--------------------------|---------------------|---------|
|                          | 1       | 14     | 21     | 28     |         |
| 0                        | 0.43    | 0.36   | 0.33   | 0.31   | 0.36    |
| 30                       | 0.42    | 0.38   | 0.34   | 0.33   | 0.37    |
| 40                       | 0.43    | 0.38   | 0.34   | 0.33   | 0.37    |
| 50                       | 0.43    | 0.36   | 0.35   | 0.33   | 0.37    |
| Average                  | 0.42<sup>c</sup> | 0.37<sup>b</sup> | 0.34<sup>a</sup> | 0.32<sup>a</sup> |

Different superscripts on the same line show significantly different between treatments (P<0.01).

Storage time is very influential on the yolk unit index of yolk. However, there was no interaction between the level of melinjo leaf extract and storage time. The duration of storage shows that the longer the storage, the average value of the yolk index decreases. Storage duration of 1 day indicates quality II and storage of 14, 21 and 28 days indicates quality III. This is in accordance with the National Standardization Agency (2008) which states the egg yolk index 0.458–0.521 = quality I, 0.394–0.457 = quality II and 0.330–0.339 = quality III.

Duncan's further test results showed the longer the storage, the yolk value of the duck egg decreased. This is because the longer the storage, the quality of the yolk will also decrease due to weakening of the ovumucin fiber which is affected by the increase in pH so that the vitelin membrane becomes more elastic. Evaporation of CO₂ gas during the storage period which causes the pH to rise and cause the ovumucin to be damaged so that water cannot be bound anymore by the egg whites and will move to the yolk through the viteline membrane and cause the yolk diameter to enlarge [16].
4. Conclusion

Increasing levels of melinjo leaf extract can maintain the quality of duck eggs, while storage time decreases the quality of duck eggs.

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