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A sensory evaluation of the preservation of chicken eggs using an herbal coating during cold storage

Uji sensori pengawetan telur ayam ras dengan pelapisan bahan herbal selama penyimpanan dingin

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ABSTRACT

This study aimed to determine the sensory test of chicken eggs coated with herbal ingredients. This study used 240 0-day-old chicken eggs coated with herbal ingredients stored at cold temperatures of 4°C for 20 days. The treatment factors consisted of: T0: no coating (control), T1: coating eggshells with lemongrass solution, T2: coating eggshells with kaffir lime leaf solution, and T3: coating eggshells with pandan leaf solution. Sensory testing was carried out by boiling 20-day-old eggs for 8 minutes and the panelists assessed the color, aroma, taste, and texture. Data were analyzed using ANOVA with Duncan's multiple range test (DMRT) advanced test at a significance level of 0.05. Sensory testing showed that eggs without treatment (control) and egg coating using lemongrass solution, lime leaf solution, and pandan leaf solution did not significantly affect the egg yolk color, the egg white color, and the egg texture at the level of panelist preference. The egg taste and aroma coated with lime leaf solution had the lowest preference level. The conclusion of the sensory test of color, aroma, taste, and texture of eggs coated with lemongrass and pandan leaf solution was acceptable to the panelists.

Kata kunci:
Tanaman herbal
Pelapisan telur
Penyimpanan
Uji sensori

ABSTRAK

Tujuan penelitian ini adalah untuk mengetahui uji sensoris telur ayam yang dilapisi bahan herbal. Penelitian ini menggunakan 240 butir telur ayam umur 0 hari yang dilapisi bahan herbal yang disimpan pada suhu dingin selama 20 hari. Faktor perlakuan terdiri dari: P0: tanpa pelapisan (kontrol), P1: pelapisan kerabang dengan larutan serai, P2: pelapisan kerabang dengan larutan daun jeruk purut, P3: pelapisan kerabang dengan larutan daun pandan. Pengujian sensoris dilakukan dengan merebus telur umur 20 hari selama 8 menit kemudian panelis menilai warna, aroma, rasa dan tekstur. Data dianalisis menggunakan ANOVA dengan uji lanjut Duncan's multiple range test (DMRT) pada tingkat signifikansi 0,05. Pengujian sensoris menunjukkan bahwa telur tanpa perlakuan (kontrol) dan pelapisan telur menggunakan larutan serai, larutan daun jeruk purut dan larutan daun pandan tidak berpengaruh nyata terhadap warna kuning telur, warna putih telur dan tekstur telur pada tingkat kesukaan panelis. Rasa dan aroma telur yang dilapisi larutan daun jeruk purut memiliki tingkat kesukaan yang paling rendah. Kesimpulan uji sensoris warna, aroma, rasa dan tekstur telur yang dilapisi larutan serai dan larutan daun pandan dapat diterima oleh panelis.

INTRODUCTION

Chicken eggs are a source of animal protein that is easy to obtain, high in protein, and cheap in price. Generally, most foods and cooking involve the use of eggs as one of the ingredients. The consumption of chicken eggs in Indonesia is increasing from year by year. Per capita consumption of chicken eggs per week in 2022 for chicken eggs will increase by 2.31 percent, and free-range chicken eggs will increase by 5.71 percent. According to the Directorate General of Livestock and Animal Health (2024) broiler chicken egg production will increase from 5.2 million tons in 2021 to 6.1 million tons. The interior quality of chicken eggs will decrease every day, and over time, they will become damaged. Chicken eggs can last 5-10 days of storage at room temperature (Saputri, Nur'aini, & Marhamah, 2024). Apart from that, damaged eggs can potentially be contaminated with pathogenic microorganisms that are dangerous to health. Therefore, technology for preserving whole eggs from chickens is needed to extend the shelf life of eggs.

The technology for preserving fresh whole eggs can be done by coating the eggshells using protein, polysaccharides, oil, and bioactives. These ingredients are easy to find in natural foods that we often consume daily, so they can be used as eggshell coatings. The purpose of eggshell coating is to protect the pores of the eggshell to prevent evaporation of CO2 and water and the entry of microbes into the egg. Coating eggshells with protein can use whey protein isolate (WPI) or concentrate (WPC) (Caner & Yüceer, 2015) and rice protein concentrate (RPC) (Gabriela da Silva Pires et al., 2021). Polysaccharide coatings can use chitosan (Yuceer & Caner, 2014), sweet potato starch (Eddin & Tahergorabi, 2019), and yam starch (Mota et al., 2017). Oil coating can use mineral oil (Jones, Ward, Regmi, & Karcher, 2018). Coating with bioactive ingredients can use propolis (Aygun & Sert, 2013). Eggshell coating materials made from natural ingredients are elementary to obtain, especially in Indonesia. Lemongrass (Cymbopogon citratus DC) is generally used as a cooking spice and herbal medicine. Lemongrass contains antimicrobial and antioxidant properties (Muala, Desobgo, & Jong, 2021). Kaffir lime leaves (Citrus hystrix) are also used as a cooking spice and contain antioxidants (Anuchapreeda et al., 2020) and antibacterial (Ulhaq, Hendyatama, Hameed, & Santosaningsih, 2021). Pandan leaves (Pandanus amaryllifolius) contain ethyl acetate fraction as a natural antioxidant (Suryani, Murti, Ardiyan, & Setyowati, 2018).

The antioxidant and antimicrobial content have the potential as a food preservative. However, a higher percentage of natural ingredients used will affect the organoleptic of the eggs. Research by Yani & Suryono (2021) using a 15% bay leaf solution was able to extend the shelf life of eggs for 6 days without affecting the organoleptic. According to Novitanti, Suharyanto, Soetrisno, & Warnoto (2021) using a melinjo solution of up to 45% for 21 days affected the taste and aroma of the eggs.

Cold storage can also extend the shelf life of fresh whole eggs. Cold temperatures can inhibit chemical reactions and the growth of microorganisms so that eggs are not easily damaged (Saputri et al., 2024). A combination of eggshell coating and cold storage can be used to optimize egg shelf life. Gabriela da Silva Pires et al. (2021) research used a combination of 20°C and coating eggshells with propolis. Another study used a temperature of 20°C and coating with rice protein (Gabriela da Silva Pires, Daniela da Silva Pires, Cardinal, & Bavaresco, 2020). Combining these two methods can be integrated with an automatic system. Eggshell coating is carried out using spraying preservatives periodically during cold storage. The research aimed to determine the quality of chicken eggs that were given herbal preservatives during cold storage through sensory tests.

MATERIALS AND METHODS

Materials

This study used 240 0-day-old chicken eggs of the Lohman strain. The eggshell coating ingredients consist of lemongrass, kaffir lime leaves, and pandan leaves.

Methods

This research used a Completely Randomized Design with four treatments and

six replications. The treatment factors consist of: T0: no coating (control), T1: coating eggshells with lemongrass solution, T2: coating eggshells with kaffir lime leaf solution, and T3: coating eggshells with pandan leaf solution. The egg treatment was stored in cold storage at 4°C. Each treatment used 40 eggs. According to Saputri et al. (2024) making an herbal solution is done by washing pandan leaves, kaffir lime leaves, and lemongrass, then weighing 700 g of the ingredients. The ingredients are cut into small pieces, added with 1 liter of water, and blended until smooth. The combined solution is then filtered and boiled until boiling for 2 minutes. The cooled herbal solution is then put into a bottle and then closed tightly. The eggshells are cleaned and then stored in a modified refrigerator. Spraying of herbal ingredients is carried out 30 minutes every day for 20 days of storage.

Sensory Test

Eggs preserved for 20 days were then subjected to sensory testing by 50 inexperienced panelists. The panelist criteria consist of male and female gender aged 30-50 years. Measuring the quality of chicken eggs is done by boiling them and then serving them to the panelists and assessing them based on color, aroma, texture, and taste. According to Nur'aini, Suningsih, & Hakim (2020) the panelists' assessments used five hedonic scales consisting of: (1) extremely dislike, (2) dislike, (3) rather dislike, (4) like, and (6) extremely like.

Data Analysis

Data analysis was conducted using ANOVA at a confidence level of 95%. If the research results have a real effect, Duncan's multiple range test (DMRT) will be carried out further (Nur'aini et al., 2020).

RESULTS AND DISCUSSION

Sensory tests were carried out to determine the level of panelists' preference for the quality of purebred chicken eggs preserved with herbal ingredients during cold storage. The assessment is based on egg yolk color, egg white color, aroma, texture, and taste.

Egg Yolk Color

Color is the first sensory parameter in determining food quality using the sense of sight (Ray, 2021). Untreated chicken eggs (control) and coated of herbal ingredients using lemongrass solution, kaffir lime leaf solution and pandan solution produced a yellow color which the panelists still accepted. The sensory analysis results on egg yolk color had no significant effect (Table 1). The egg yolk color score after 20 days in treatments T0, T2, T2, and T3 showed no any difference, ranging from 4.47 to 4.57. Although lemongrass, kaffir lime leaves, and pandan leaves have chlorophyll as a food coloring, coating the eggshell with these ingredients does not affect the color of the egg yolk. This is because the chlorophyll only coats the eggshell and does not penetrate the egg. The color of the egg yolk is influenced by carotenoid pigments that cannot be synthesized by the poultry body so it must be available in the feed. One source of energy that contains a lot of carotene in the form of xanthophyll is corn (Lestari, Riyanti, & Wanniatie, 2015). Feed with higher levels of carotenoids will produce a yellower egg yolk color.

Eggs that are stored for a long time will experience changes in the lysozyme bonds so that the thick egg white becomes runny. Cold storage inhibits water movement from the watery egg white to the egg yolk so that the egg yolk is still intact or not broken. This results in the color of the egg yolk not changing during 20 days of storage.

Egg White Color

The preservative coating did not significantly affect egg white color during 20 days of cold storage (Table 1). The egg white color score after 20 days in treatments T0, T2, T2, and T3 showed no difference, ranging from 4.50 to 4.65. The sensory analysis results of egg white color were still acceptable to the panelists. Lemongrass solution, kaffir lime leaf solution, and pandan leaf solution have green leaf substances that can be used as food coloring. Spraying a preservative solution with a low concentration for 20 minutes daily only coasts the outer eggshell. After spraying, the solution will immediately dry due to cold storage.

Table 1. Results of sensory analysis of egg preservation by coating with herbal ingredients during cold storage

Treatment	Egg yolk color	Egg white color	Odor	Texture	Taste
T0	4.50±0.97^{ns}	4.50±0.80^{ns}	4.47±1.24^{a}	4.20±1.82^{ns}	4.27±1.36^{b}
T1	4.47±1.24^{ns}	4.65±0.92^{ns}	4.53±1.24^{a}	4.60±1.22^{ns}	4.60±1.22^{b}
T2	4.57±1.54^{ns}	4.57±1.05^{ns}	3.60±1.76^{b}	4.07±1.71^{ns}	3.53±1.44^{a}
T3	4.53±1.24^{ns}	4.63±1.00^{ns}	4.60±0.94^{a}	4.40±1.22^{ns}	4.53±1.00^{b}

^{ns}Non significant

^{ab}Different superscripts in the same row indicate significant differences (P<0.05)

This causes the green leaf dye not to penetrate the egg so that there is no color change in the egg white. Egg whites are white. Tooy, Lontaan, Karisoh, & Wahyuni (2021) shows that soaking eggs using a tea solution with a content of 60-70% can penetrate the pores of the eggshell so that evaporation is higher and egg weight decreases. The tannin levels in green tea or black tea can give color to eggs with the appropriate concentration and type of preservation (Tooy et al., 2021).

Aroma

The sensory analysis results showed the effect of egg coating in a cold storage period on egg aroma (Table 1). Eggs will experience changes in quality during storage. Eggs that are stored longer will experience changes in protein and fat, thus affecting the egg's aroma (Scatolini-Silva et al., 2013). The aroma of the T3 treatment eggs had the lowest value, which was 3.60, meaning that the panelists liked the aroma of eggs coated with the kaffir lime solution less than the other treatments. The aroma of the control treatment eggs was 4.47, lower than the T2 treatment of 4.53 and the T4 treatment of 4.60. The sensory odor test of eggs without treatment (control) and with a coating of herbal ingredients using lemongrass solution and pandan leaf solution was acceptable to the panelists.

The smell of eggs coated with kaffir lime leaf solution was somewhat liked by the panelists due to the distinctive smell of the eggs. Kaffir lime leaves contain citronellal which is used as the main raw material for producing essential oils (Hakim, Mulyani, Hendrawati, & Ismiyati, 2019). Regular spraying of kaffir lime leaf solution can affect the aroma of the eggs. Apart from that, the kaffir lime leaf solution is replaced regularly every 5 days so that the solution is always fresh and the antimicrobial and antioxidant ingredients are in good condition. The good quality of the lime leaf solution with its distinctive smell is absorbed by the eggs, resulting in eggs scented with kaffir lime leaf solution. The aroma components of essential oils quickly interact when inhaled and interact with the central nervous system (Muchtaridi et al., 2019). This is supported by research Brasil et al. (2019) which used a coating of copaiba oil solution with a distinctive odor so that it affected the aroma, appearance, and taste.

Texture

The results of sensory texture analysis of eggs without treatment (control) and those coated with preservatives were not significantly different (Table 1). The texture of eggs after 20 days in treatments T0, T2, T2, and T3 showed no difference, ranging from 4.07 to 4.60. The similarity of egg cooking time and temperature is thought to cause the amount of coagulated protein to be the same, resulting in the same texture. The texture of untreated egg whites is the same as the texture of treated eggs, that is, they are springy. The chewy texture is caused by protein denaturation due to boiling the eggs. Protein denaturation causes egg whites to clump and solidify. Likewise, those of untreated egg yolks is just as soft as the texture of treated egg yolks.

The herbal ingredients in the lemongrass leaf solution, kaffir lime leaf solution, and pandan solution only coat the eggshells with antimicrobials and antioxidants and do not affect the egg's water content. Research Oliveira, McManus, Salgado, Pires, & dos Santos (2023) shows that coating eggshells with rice flour and rosemary essential oil does not affect the sensory characteristics of quail eggs. The herbal ingredients used not only have active

antibacterial and antioxidant ingredients, but these herbal ingredients contain tannins (Pramono, Juafar, & Ginting, 2024; Ramadhan, Fachriyah, & Kusrini, 2022). Tannins from lemongrass, kaffir lime leaves, and pandan leaves have polyphenol groups in their structure so that they can bind and precipitate protein from eggs (Ismarani, 2012). However, the tannin content does not affect the texture of the eggs.

Taste

Coating herbal ingredients for 20 days in cold storage had a significant effect on the taste of the eggs. The taste of the eggs in treatment T3 had the lowest value of 3.53, which means that the panelists did not like the taste of the eggs coated with kaffir lime solution compared to other treatments. The taste of the eggs in treatment T0 was 4.27, lower than treatment T2 at 4.60 and treatment T4 at 4.53. Eggs without coating ingredients. Coated with lemongrass solution and pandan leaf solution, the taste that was acceptable to the panelists, even though the taste score for eggs coated with lemongrass solution and pandan solution was higher.

Eggs coated with kaffir lime leaf solution had the lowest taste score, meaning the panelists somewhat disliked them. This is because kaffir lime leaves have a stronger smell than pandan and lemongrass leaves. Kaffir lime leaves contain volatile compounds containing citronellal essential oil, which is used in the perfume and soap fragrance industries (Kawiji, Khasanah, Utami, & Aryani, 2015). Kaffir lime leaves are generally also used to add aroma to cooking. If you use too many kaffir lime leaves, it will cause a bitter taste in the food. Spraying the kaffir lime leaf solution is carried out periodically for 30 minutes every day for 20 days so that the distinctive smell can penetrate the eggs and affect the taste of the eggs. Coating eggs with copaiba oil, which has a distinctive odor, is gradually absorbed into the egg during 18 days of storage so that it can be felt by the taster (Brasil et al., 2019). The development and application of eggshell coatings with materials containing essential oils with a strong and distinctive odor need to be considered in terms of consumer acceptance (Pedrós-Garrido et al., 2020).

CONCLUSIONS

Based on the panelists' assessment of the sensory test, coating eggs using lemongrass solution, kaffir lime leaf solution, and pandan leaf solution did not have a significant effect on the sensory test of egg yolk color, egg white color, and egg texture. However, the taste and aroma of eggs coated with kaffir lime leaf solution had the lowest level of panelist preference because of the distinctive aroma of kaffir lime leaves that permeated the eggs. Overall, the sensory test of color, aroma, taste, and texture of eggs coated with lemongrass solution and pandan leaf solution was most preferred by panelists.

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