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Organoleptic Assessment, Protein Content, and Fat Content of Broiler Chicken Eggs Soaked in Mangosteen Peel Extract (*Garcinia mangostana* L.) During Storage

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A B S T R A C T

The purpose of this study was to determine the organoleptic assessment, protein content, and fat content of broiler chicken eggs soaked in mangosteen peel extract (Garcinia mangostana L.) during storage. The research design used was a completely randomized design factorial pattern consisting of 2 factors. The first factor was the mangosteen peel extract solution with different concentrations (0%, 5%, 10%, and 15%). The second factor was storage for 0, 1, 2, 3, and 4 weeks. The data obtained were analyzed for diversity using an ANOVA test, and if a significant effect was found (P <0.05), then the analysis continued with Duncan's test. The treatment of mangosteen peel extract concentration level did not affect the protein content, fat content, and organoleptic assessment of chicken eggs. Meanwhile, storage time had a very significant effect (P <0.01) on the protein content and fat content of chicken eggs. The protein content of chicken eggs in the treatment with a mangosteen peel concentration level ranged from 8.43% to 8.58%. The highest protein content was obtained on the 4th day of storage, namely 8.76%. The fat content of chicken eggs ranged from 4.33 to 4.51%. The lowest fat content was obtained on the 4-day storage treatment, namely 4.04%. Soaking chicken eggs in mangosteen peel extract and egg storage for up to 4 weeks did not have a significant effect on the organoleptic properties of chicken eggs.

Contribution to Sustainable Development Goals (SDGs):
SDG 1: No Poverty
SDG 2: Zero Hunger
SDG 3: Good Health and Well Being

1. INTRODUCTION

1.1. Research Background

Chicken eggs are a widely used source of animal food that is readily available and in high demand by all groups. Eggs are a source of complete animal protein, making them a superior food in the community. They are easily obtainable at an affordable price, making them safe for consumption by both children and adults [1]. Storing eggs at a constant temperature or at normal room temperature will not prolong their shelf life, as they are easily damaged. According to Rahmawati [2], eggs have a very short shelf life, only two weeks. Eggs stored for an extended period are at risk of damage and undergo changes in composition, which impact the economic value for farmers, traders, and consumers. Sudaryani [3] reported that storing eggs for a long time results in a decrease in egg quality due to the evaporation of

liquids and gases within the eggs. Therefore, efforts to prevent damage include preventing the evaporation of egg liquids and gases.

Egg preservation is based on the principle of covering the pores of intact eggs, to prevent the evaporation of water or gases from inside the egg and prevent microorganisms from entering the egg. Egg damage can be slowed by the use of chemicals such as sodium silicate, calcium hydroxide, paraffin, and vaseline [4]. However, the use of these chemicals is expensive and can be detrimental to consumers. Consumers who consume food preserved with chemicals often experience adverse effects due to the potential allergic reactions caused by these chemicals, particularly in individuals with low immunity and chemical sensitivity. In addition, the impact of chemical content in egg preservation can include itching, diarrhoea, shortness of breath, and even death. Therefore, an alternative to egg preservation has been created in the form of preservation technology using plant materials [5].

The material to be tested for egg preservation is a mangosteen peel (*Garcinia mangostana* L) solution. The benefits of mangosteen peel include its anti-inflammatory, anti-tumor, antioxidant, and antibacterial properties. Mangosteen peel is reported to be a source of tannin, xanthone, chrysanthemin, garcinone, gartanin, vitamins B1, B2, and C, and other bioactive substances (6). These antioxidant properties can play a role in protecting cells from oxidative damage, including the cells that form chicken eggs (7).

In this study, broiler chicken eggs were soaked in mangosteen peel extract to assess its effects on organoleptic quality (taste, aroma, texture, and appearance) as well as fat and protein levels during storage. The organoleptic assessment aimed to determine whether soaking chicken eggs in mangosteen peel extract could improve or maintain their quality and extend their shelf life. Meanwhile, protein and fat levels were measured to determine the egg's nutritional value during storage objectively. Mangosteen peel extract was chosen because, in addition to its potential as a natural preservative, it is also known as a source of antioxidants that are beneficial for health. This research can also serve as an environmentally friendly alternative for extending the shelf life of egg products, eliminating the need for synthetic chemicals that pose potential health risks.

1.2. Research Objective

This study aimed to determine the organoleptic assessment, protein content, and fat content of broiler chicken eggs soaked in mangosteen peel extract (Garcinia *mangostana* L) during storage.

2. MATERIALS AND METHODS

The research was conducted in the Basic Sciences Laboratory of the Faculty of Agriculture, Warmadewa University, located in Tanjung Bungkak, Sumerta Village, East Denpasar District, Denpasar City.

The tools used were sample containers, pens, paper plates, forks, pans, and stoves. The materials used in this study were 120 freshly harvested chicken eggs obtained directly from farmers. Mangosteen peels were obtained directly from farmers in the Tabanan area. Other materials used were distilled water.

This study used a factorial design with three replications. The first factor was the concentration of the mangosteen peel solution: 0%, 5%, 10%, and 15%. The second factor was storage time. Eggs were stored at room temperature and observed in weeks 0, 1, 2, 3, and 4.

The extraction method used to make the extract is maceration/soaking. The initial stage is to separate the mangosteen peel from the fruit. Next, the peel is cut into small pieces to make it easier to grind. Then, it is dried in an oven at 50°C. Then, the peel is crushed to produce a simple drug. The simple drug is then extracted using the maceration/soaking method.

Treatment Stage Eggs were soaked in a solution of mangosteen peel extract with different concentrations (0%, 5%, 10%, and 15%). P0 0% = without mangosteen peel extract + 1 litre of water, P1 5% = 50 grams of mangosteen peel extract + 1 litre of water, P2 10% = 100 grams of mangosteen peel extract + 1 litre of water, P3 15% = 150 grams of mangosteen peel extract + 1 litre of water. Egg soaking was carried out for 24 hours. Eggs were stored at room temperature for 0, 1, 2, 3, and 4 weeks. The research variables were objective observations: protein and fat. Subjective observations included organoleptic parameters such as colour, taste, aroma, texture, and overall acceptance.

The data obtained from the treatment results using the RAL factorial pattern were then analyzed using Analysis of Variance (ANOVA). If differences were found at each treatment level, they were further examined using Duncan's New Multiple Range Test (DMRT) at the 5% significance level.

3. RESULTS AND DISCUSSION

Based on the analysis of variance, it was found that the concentration level of mangosteen peel extract did not affect the protein content, fat content, and organoleptic assessment of chicken eggs. Meanwhile, storage time had a highly significant effect ($P < 0.01$) on the protein and fat content of chicken eggs. The results showed no interaction between the concentration level of mangosteen peel extract and storage time on the protein content, fat content, and organoleptic assessment of chicken eggs. The significance can be seen in Table 1.

Table 1. Significance of the treatment of mangosteen peel extract concentration and the storage time of chicken eggs

Treatment	Treatment		
	Mangosteen Peel Extract Concentration Level (L)	Storage Period (P)	LxP Interaction
Protein Content	ns	**	ns
Fat Content	ns	**	ns
Color	ns	Ns	ns
Flavor	ns	Ns	ns
Aroma	ns	Ns	ns
Texture	ns	Ns	ns
Overall Acceptance	ns	Ns	ns

Information :
ns =No significant effect (P>0.05)
* =Significantly affected (P<0.05)
** =Very significant effect (P<0.01)

Analysis of variance revealed that the concentration level of mangosteen peel extract had no significant effect ($P > 0.05$) on

the protein content of chicken eggs. Storage time had a significant impact ($P < 0.01$) on the protein content of chicken eggs, while the interaction between treatments showed no significant effect ($P > 0.01$) on the protein content of chicken eggs. The average protein content values are presented in Table 2.

The protein content of chicken eggs in the treatment with varying mangosteen peel concentration levels ranged from 8.43% to 8.58%. The study's results showed that protein levels did not differ significantly with the addition of mangosteen peel extract. Mangosteen peel extract contains bioactive compounds, such as tannins, that function as antioxidants and antimicrobials, playing a greater role in maintaining the physical quality of eggs and extending their shelf life, rather than significantly altering the protein content of chicken eggs. The results of the study are in line with Nuro et al [8] who stated that soaking broiler chicken eggs in mangosteen peel extract at various concentration levels did not significantly affect egg protein levels, but had a very significant effect on other parameters such as egg white index, egg yolk index, egg yolk color, and egg white and yolk pH.

In the storage duration treatment, the protein content of chicken eggs ranged from 8.32 to 8.76%. The highest protein content was obtained on the 4th day of storage, at 8.76%, which was not significantly different from the 2nd day of storage, at 8.57%. The study's results did not indicate a linear decrease in protein content during storage. This is likely due to the differences in the initial protein content of chicken eggs. Although researchers have homogenised the samples by taking them at the exact location and time of egg harvest, there is still a possibility of different protein levels between the chicken eggs used for the study. Storing chicken eggs at room temperature can cause physical and chemical changes, including dilution of the white and yolk due to damage to the vitelline membrane and loss of structural proteins such as ovomucin, which indirectly indicates changes or degradation of egg protein during storage [9].

Table 2. Average value of chicken protein content due to mangosteen peel concentration treatment and storage time

Treatment	Protein Content (%)	Notation
Mangosteen peel extract concentration level 0%	8.48	a
Mangosteen peel extract concentration level 5%	8.43	a
Mangosteen peel extract concentration level 10%	8.58	a
Mangosteen peel extract concentration level 15%	8.48	a
BNT 0.05		
Day 1 storage	8.33	b
2nd day storage	8.57	ab
3rd day of storage	8.32	b
4th day of storage	8.76	a
BNT 0.05	0.26	

Note: Mean values followed by the same letter in the same column indicate no significant difference in the 5% DMRT test.

The results showed that the treatment with mangosteen peel extract at varying concentrations had no effect ($P > 0.05$) on the fat content of chicken eggs. Storage time had a significant impact ($P < 0.01$) on the fat content of chicken eggs, while the interaction between treatments showed no significant effect ($P > 0.01$) on the protein content of chicken eggs. The average fat content is presented in Table 3.

The results of the study showed that the fat content of chicken eggs did not differ significantly between treatments given mangosteen peel extract at different concentration levels. The fat content of chicken eggs ranged from 4.33-4.51%. Mangosteen peel extract contains bioactive compounds, including xanthones and tannins, which exhibit antioxidant and antimicrobial effects [8]. These compounds play a significant role in maintaining the physical quality and freshness of eggs by inhibiting the growth of microorganisms and preventing the oxidation of egg components, rather than directly altering the fat content of eggs [10]. The fat content of chicken eggs is primarily determined by the chicken's metabolism and feed composition. Hence, the administration of mangosteen peel extract to eggs tends not to directly affect the fat content quantitatively [11].

Table 3. Average value of chicken fat content due to mangosteen peel concentration treatment and storage time

Treatment	Fat Content (%)
Mangosteen peel extract concentration level 0%	4.47 a
Mangosteen peel extract concentration level 5%	4.51 a
Mangosteen peel extract concentration level 10%	4.33 a
Mangosteen peel extract concentration level 15%	4.64 a
BNT 0.05	
Day 1 storage	4.89 a
2nd day storage	4.48 a
3rd day of storage	4.55 a
4th day of storage	4.04 a
BNT 0.05	0.40

Note: Mean values followed by the same letter in the same column indicate no significant difference in the 5% DMRT test.

Storage time has a very significant effect ($P<0.01$) on the fat content of chicken eggs. The lowest fat content was observed in the 4-day storage treatment, at 4.04%, which was significantly different from the other storage periods. The results showed that the longer the storage period, the lower the fat content. This decrease in fat content is attributed to physical and chemical changes that occur during storage, such as water evaporation and degradation of egg components, which can reduce the overall fat content [12]. Several studies have reported that the fat content of eggs decreases significantly ($p < 0.05$) with increasing storage time. Environmental factors such as storage temperature and humidity also affect the rate of decline in fat content [13]. At room temperature, the decrease in fat content and changes in egg quality occur more quickly than at cold temperatures [14].

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The treatment of mangosteen peel extract and storage time showed no significant effect on the organoleptic assessment of color, taste, aroma, texture, and overall evaluation of chicken eggs. The organoleptic values can be seen in Table 4.

Table 4. Organoleptic values of color, taste, and texture of eggs
Organoleptic values of color, taste, and texture of eggs

Treatment (Mangosteen Peel: Storage)	Color		Flavor		Texture	
0% : 1 day	4.00	a	4.00	a	4.00	a
5% : 1 day	4.00	a	4.00	a	4.00	a
10% : 1 day	3.90	a	3.90	a	4.00	a
15% : 1 day	4.00	a	4.00	a	4.00	a
0% : 2 days	3.90	a	3.80	a	3.80	a
5% : 2 days	4.00	a	4.00	a	4.00	a
10% : 2 days	3.90	a	3.90	a	3.90	a
15% : 2 days	4.00	a	4.00	a	4.00	a
0% : 3 days	4.00	a	4.00	a	3.90	a
5% : 3 days	4.00	a	4.00	a	4.00	a
10% : 3 days	4.00	a	4.00	a	3.90	a
15% : 3 days	4.00	a	4.00	a	4.00	a
0% : 4 days	2.90	a	3.50	a	3.60	a
5% : 4 days	3.70	a	3.90	a	3.90	a
10% : 4 days	3.60	a	3.70	a	3.70	a
15% : 4 days	3.70	a	3.70	a	3.70	a

Note: Mean values followed by the same letter in the same column indicate no significant difference in the 5% DMRT test.

Organoleptic assessment relies on human perception (panellists), so there is a limit to the sensitivity to small changes in colour, taste, aroma, and texture [15]. In this study, changes that occurred during treatment and storage did not show significant results. Mangosteen peel extract contains bioactive compounds that have potential as antioxidants and antimicrobials [16].

Table 5. Organoleptic values of aroma and overall acceptance

Treatment (Mangosteen Peel: Storage)	Aroma		Overall Acceptance	
0% : 1 day	4.00	a	4.00	a
5% : 1 day	4.00	a	4.00	a
10% : 1 day	4.00	a	4.00	a
15% : 1 day	4.00	a	4.00	a
0% : 2 days	3.90	a	4.00	a
5% : 2 days	4.00	a	4.00	a
10% : 2 days	3.90	a	3.90	a
15% : 2 days	4.00	a	4.00	a
0% : 3 days	4.00	a	3.90	a
5% : 3 days	4.00	a	4.00	a
10% : 3 days	3.90	a	3.90	a
15% : 3 days	4.00	a	4.00	a
0% : 4 days	3.80	a	3.60	a
5% : 4 days	3.90	a	3.80	a
10% : 4 days	3.70	a	3.70	a
15% : 4 days	3.70	a	3.70	a

Note: Mean values followed by the same letter in the same column indicate no significant difference in the 5% DMRT test.

The amount or concentration used in the treatment may not be substantial enough to produce significant changes in the color, taste, aroma, and texture attributes of eggs. Likewise, during the storage period tested, organoleptic changes in the eggs were not significant enough to be detected by the panellists.

4. CONCLUSION

The treatment of mangosteen peel extract at varying concentrations did not affect the protein content, fat content, or organoleptic assessment of chicken eggs. Meanwhile, storage time had a significant effect ($P < 0.01$) on the protein and fat content of chicken eggs. The protein content of chicken eggs in the treatment with a mangosteen peel concentration level ranged from 8.43% to 8.58%. The highest protein content was obtained on the 4th day of storage, namely 8.76%. The fat content of chicken eggs ranged from 4.33 - 4.51%. The lowest fat content was obtained on the 4-day storage treatment, namely 4.04%. Soaking chicken eggs in mangosteen peel extract and storing them for up to 4 weeks did not have a significant effect on the organoleptic properties of the chicken eggs.

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