Jurnal Peternakan Integratif
Journal homepage: https://talenta.usu.ac.id/jpi/workflow/index/16319/3

Effect of *Moringa oleifera* L. Leaf Solution Concentration and Length of Storage on the Internal Quality of Duck Eggs (*Anas platyrhyncos domesticus*)

Melda Silalahi[*1] , Sayed Umar[1] , Nurzainah Ginting[1], Ibrahim N Syaheera[2]
[1]*Animal Science Study Program, Facullty of Agriculture, Universitas Sumatera Utara, Medan 20155, Indonesia*
[2]*N I School of Animal Science, Aquatic Science, and Environment, Faculty of Bioresource and Food Indistry, Universiti Sultan Zainal Abidin, Besut Campus, 22200 Besut, Terengganu Darul Iman, Malaysia.*
[*]Corresponding Author: sayed_umar@usu.ac.id

ARTICLE INFO
Article history:
Received July 30, 2024
Revised November 9, 2024
Accepted November 9, 2024
Available online November 10, 2024

E-ISSN: 2808-2753

How to cite:
Melda Silalahi, Sayed Umar, Nurzainah Ginting Ibrahim N Syaheera, Effect of Moringa oleifera L. Leaf Solution Concentration and Length of Storage on the Internal Quality of Duck Eggs (Anas platyrhyncos domesticus)
Jurnal Peternakan Integratif, Vol. 12,No.02,pp.93-99 August.2024, doi: 10.32734/jpi.v12i2.17773

ABSTRACT

Duck eggs have a delicious taste, are easily digested by the body, and contain quite good nutrition.However, duck eggs have a short self life. This study aims to determine the effect of the length of storage and concentration of Moringa leaf solution on the internal quality of duck eggs. This study was conducted in September-October 2023 at the Livestock Production Laboratory of Animal Husbandry Study Program, Faculty of Agriculture, Universitas Sumatera Utara. The design used in this study is a complete random design, factorial pattern, namely 4 concentration solution treatment (R0 = without soaking, R1 = 10%, R2 = 20%, R3 = 30%), 5 Treatment of Length of Storage (L0 = 0 days, L1 = 7 days, L2 = 14 days, L3 = 21 days, L4 = 28 days) with 2 replications. The parameters used in this study include the egg white index (albumen), the egg yolk index (yolk), the percentage of decreased egg weight and the degree of acidity (pH) of eggs. The results showed that the number of concentrations of 30% solution had a significant effect ($p < 0.05$) on the albumen index, yolk index and pH, but did not affect the percentage of decreased egg weight. The length of storage has a significant effect on the internal quality of duck eggs. The treatment interaction is a significant effect ($p < 0.05$) against the egg white index (albumen) and egg pH. Treatment with a 30% moringa leaf solution had better results for 28 days compared to treatment without soaking.

Keyword: Albumen, Concentration solution, Duck eggs, Yolk, Length of storage

http://doi.org/10.32734/jpi.v12i2.17773

1. Introduction

Eggs are a product produced by poultry farming which have a delicious taste, are easily digested by the body, and contain quite good nutrition. However, it turns out that eggs are also a product that is easily contaminated by bacteria or microorganisms, making them susceptible to damage. In addition, the longer the storage time causes a decrease in egg quality *[1]*. Long storage before distribution will cause a decrease in quality, which is caused by microbes. Microbes utilize the high nutritional content found in eggs for their growth. Eggs can experience physical and chemical changes as a result of microbial activity *[2]*. The short shelf life of eggs means that storage at room temperature is limited.

Proper preservation is required. The aim of preserving eggs is to extend the shelf life of eggs and maintain their quality [3]. According to [4], the storage capacity of eggs at room temperature is very short, around two weeks. The main thing to remember when preserving eggs is to maintain ideal internal conditions so that the eggs are not easily affected by external environmental influences. In addition, it is very important to prevent the release of internal gases and evaporation of water from the eggs. According to [5], eggs must be soaked in vegetable matter containing tannin to maintain quality and increase shelf life.

Moringa leaves are a plant that contains tannin. The application of moringa leaves has been the subject of extensive research. Included in research by [6], revealed that the secondary metabolic compounds found in Moringa leaves include terpenoids, flavonoids, alkaloids, tannins and saponins. The value of the amount of tannin in dried Moringa leaves ranges between 13.2 g / kg and 20.6 g / kg [7]. A study from [5, 8, 9] influential results were obtained when studying the impact of soaking eggs in a solution made from Moringa leaves for 24 hours to determine the effect of the solution on the internal quality of broiler chicken eggs in terms of the egg white index, and haugh units. Based on these findings, the author want to study the effect of varying concentrations of Moringa leaf solution of 0%, 10%, 20%, and 30% on the internal quality of duck eggs for 0 days, 7 days, 14 days, 21 days, and 28 days after soaking for 24 hours.

2. Method

The research was conducted from September to October 2023, at the Animal Production Laboratory, Animal Science Study Program, Faculty of Agriculture, Universitas of Sumatra Utara. The ingredients used are fresh, green Moringa leaves, clean water, and duck eggs from 58 week old Mojosari ducks, laid on the same day. Eggs were obtained from Mr Purwono Suryantyo's farm, namely CV. Bebek Berkah Farm on Jalan Mulia, Tuntungan II No. 6, Pancur Batu District, Medan City, North Sumatra. Eggs are selected that are clean, the shell has no cracks, the shell texture is smooth, and oval in shape. In this study, eggs were selected based on selecting the outside of the egg, with a uniform color.

The tools in this research are plastic egg tray as a container for eggs when stored, a digital scale with the Electronic Kitchen Scale brand which has an accuracy level of 10 grams for weighing the weight of Moringa leaves, and a digital scale with an accuracy of 0.1 grams as weighing the egg, a caliper used to measure the height and width of the yolk and albumen with an accuracy of 0.05 mm, a glass table to see the internal condition of the broken egg, a thermohygrometer as a tool for measuring temperature and humidity during storage, digital pH meter, 3 large jars with tight lids as containers for making Moringa leaf solution, filter to filter Moringa leaf dregs, alcohol to sterilize equipment before storage, sprayer for alcohol containers.

In this study, two factors were examined in an experiment with a Completely Randomized Factorial Design (CRD). The treatments or factors given are:

1. Concentration factor of Moringa leaf solution with 4 levels, namely:
R0: Without soaking with Moringa leaf solution (control);
R1: Soaking eggs at a concentration of 10% (w/v);
R2: Soaking eggs at a concentration of 20% (w/v);
R3: Soaking eggs at a concentration of 30% (w/v).
2. Storage time factor with 5 levels, namely:
L0 : No storage (control);
L1: 7 days storage;
L2: 14 days storage;
L3: Storage 21 days;
L4 : Storage 28 days.

The data obtained in the study were analyzed using (ANOVA) according to the Factorial Completely Randomized Design procedure. After that, the analysis continued with Duncan's Multiple Range Test (DMRT) at the 5% level [10].

3. Result and Discussion

3.1. Egg White Index (albumen)

The typical duck egg white index value ranges from 0.074 to 0.093 mm according to research results. The average egg white index for each treatment is shown in Table 1. The R3 concentration (30% concentration) had the highest average albumen index (0.093 mm) during the 28 day storage period. Followed by R2 (20%), R1 (10%), and R0 (0% concentration), with amounts of 0.082 mm, 0.077 mm, and 0.074 mm respectively. The average albumen index for the maximum shelf life treatment was measured at 0.136 mm at L0 (0 days). Followed by L1 (7 days), L2 (14 days), L3 (21 days), and L4 (28 days), respectively 0.100 mm, 0.069 mm, 0.054 mm, and 0.046 mm. The R0L4 treatment gave the lowest egg white index results of 0.033 mm, while the R3L0 treatment gave the highest results, namely 0.140 mm. The best treatment is R3L0.

Table 1. Average index of egg white (albumen) with soaking time and concentration of Moringa leaf solution (mm)

Solution Concentration	Storage Time					Mean ±SD
	L0 (0 Day)	L1 (7 Days)	L2 (14 Days)	L3 (21 Days)	L4 (28 Days)	
R0 (0 %)	0,138	0,092	0,061	0,045	0,033	$0,074^{a}$±0,042
R1(10%)	0,135	0,101	0,064	0,047	0,035	$0,077^{a}$±0,041
R2(20 %)	0,134	0,102	0,075	0,051	0,046	$0,082^{b}$±0,037
R3(30 %)	0,140	0,107	0,077	0,074	0,069	$0,093^{c}$±0,030
Mean ± SD	$0,136^{e}$± 0,003	$0,100^{d}$± 0,006	$0,069^{c}$± 0,008	$0,054^{b}$± 0,013	$0,046^{a}$± 0,016	

Note: Different superscripts indicate rows and columns indicate significant difference (P<0.05).

Based on the results of the analysis of variance , treatment with a concentrated solution of Moringa leaves had a significant effect (P<0.05) on egg quality as measured by the albumen index. The results for storage time (L factor) were also significant (P<0.05). The interaction that occurred between the R factor (solution concentration) and the L factor (storage time) produced a significant influence (P<0.05). According to Duncan's further test results, soaking eggs in a solution containing moringa also had a significant effect (P<0.05) on the egg white index. Table 1 shows that treatment R0 is significantly different (P<0.05) from treatments R2 and R3, but not significantly different (P>0.05) from treatment R1. Furthermore, from treatments R2 and R3, treatment R1 was significantly different (P<0.05) but not significantly different (P>0.05) from R0. The interaction that occurred between the Moringa leaf solution concentration treatment and the storage time showed that the higher the Moringa leaf solution produced the best quality, while the longer the storage period, the lower the quality of the egg albumen index.

The index value of egg whites soaked in Moringa leaf solution gave better results than the index value of egg whites that were not soaked in the solution. This is in line with research by [5], who found that eggs soaked in a 30% Moringa leaf solution were able to maintain the egg white quality index in purebred chickens. According to research by [9], soaking chicken eggs in a solution containing Moringa leaves increases the egg white index because the tannins in the leaves close the pores of the egg shell, thereby preventing bacteria and CO2 gas from entering the egg. Based on research by [8], by reacting with proteins on the surface of egg shells, the tannins in Moringa leaves create a layer that is impermeable to gas. Apart from that, the antimicrobial properties of tannins and saponins are found in Moringa leaves. Tannins have the ability to stop the growth of bacteria by destroying the cell walls and changing the protein structure, which causes the bacteria to die. Research by [6], revealed that various secondary metabolite compounds, including tannins, saponins, anthraquinones, steroids, alkaloids, flavonoids and terpenoids, are found in Moringa leaves.

3.2. Yolk Egg Index

The yolk index of the Moringa leaf solution soaking treatment reached its peak at R3 (30% concentration) of 0.364 mm during a storage period of 28 days. R2 (20%), R1 (10%), and R0 (0% concentration) are next, with totals of 0.352 mm, 0.334 mm, and 0.297 mm, respectively. The average yolk index result for eggs treated with the highest shelf life was found at L0 (0 days) at 0.495 mm. Followed by L1 (7 days), L2 (14 days), L3 (21 days), and L4 (28 days) for each treatment of 0.448 mm, 0.372 mm, 0.249 mm, and 0.118 mm. The egg yolk index results for the R3L0 treatment had the highest value, namely 0.513 mm, while the R0L4 treatment had the lowest value, namely 0.106 mm. The best treatment is R3L0.

Table 2. Average egg yolk index with soaking time and Moringa leaf solution concentration (mm)

Solution Concretation	Storage Time					Mean ±SD
	L0 (0 Day)	L1 (7 Days)	L2 (14 Days)	L3 (21 Days)	L4 (28 Days)	
R0 (0 %)	0,476	0,422	0,339	0,139	0,106	$0,297^{a}$±0,167
R1(10%)	0,481	0,441	0,357	0,284	0,107	$0,334^{b}$±0,148
R2(20 %)	0,508	0,459	0,391	0,285	0,114	$0,352^{bc}$±0,158
R3(30 %)	0,513	0,469	0,403	0,289	0,146	$0,364^{c}$±0,147
Mean ±SD	$0,495^{e}$± 0,019	$0,448^{d}$± 0,021	$0,372^{c}$± 0,029	$0,249^{b}$± 0,074	$0,118^{a}$± 0,019	

Note: Different superscripts indicate rows and columns indicate significant difference (P<0.05).

The results of the analysis of variance illustrate that the concentration of the treatment solution (R factor) and storage time (L factor) have a large influence (P<0.05) on the quality of the inside of the egg as determined by the egg yolk index. There was no significant difference in the results of the interaction between factor R (solution concentration) and factor L (storage time) (P>0.05). Table 2 shows that there is a significant difference (P<0.05) between treatments R0, R1, R2, and R3. In addition, treatment R1 was significantly different (P<0.05) from treatment R3, but not significantly different (P>0.05) from treatment R2. The interaction of treatments resulted that the higher the Moringa leaf solution produced the best quality, while the longer the shelf life, the lower the quality of the egg yolk index. One way to find out how fresh an egg is is to look at the yolk index value. The eggs are relatively fresh based on their height and small yolk diameter. Based on research findings (Table 2), the egg yolk index value was less than 0.330 mm on days 21 and 28. The quality of the egg yolk decreased after storage. This agrees with research conducted by [11] which found that duck eggs that had not been treated for more than two weeks had a lower yolk quality index. In other words, after being stored for almost three weeks, the quality index of the egg yolk decreased. The yolk index resulting from this research is that eggs at 0 days of storage are 0.374 mm, while the value for 15 days of storage is 0.312 mm and 30 days is 0.074 mm. Based on the research results of [12], revealed that for duck eggs with 0 days of storage, the egg yolk index was 0.45 mm, while the value for 7 days of storage was 0.42 mm and 14 days was 0.38 mm.

3.3. Percentage Reduction in Egg Weight

During the 28 day storage period, the treatment with the lowest environmental concentration of Moringa leaves showed the greatest average reduction in egg weight. 69.73 ± 2.66 grams is the average weight of duck eggs during the study. This was observed at R3 (30% concentration) and R2 (20% concentration) at 2.10% and 2.11% respectively. R0 (0 concentration) and R1 (10%) with concentrations of 2.13% and 2.15%. The highest average reduction in egg weight in the shelf life treatment occurred in treatment L4 (28 days) at 5.53% and continued with L3 (21st day), L2 (14th day), L1 (7th day) and L0 (7th day). 0) with respective amounts of 3.15%, 1.13%, 0.81% and 0.00%. The results of the R0L4 treatment on day 28 with the largest percentage reduction in egg weight were 5.56% and the R3L4 treatment with the lowest percentage was 5.50%. The best treatment after storing eggs for 28 days is R3L1.

Table 3. Average percentage reduction in egg weight with soaking time and Moringa leaf solution concentration (%).

Solution Concentration	Storage Time					Mean±SD
	L0 (0 Day)	L1 (7 Days)	L2 (14 Days)	L3 (21 Days)	L4 (28 Days)	
R0 (0 %)	0,00	0,89	1,13	3,18	5,56	$2,15^{a}$±2,23
R1(10%)	0,00	0,81	1,14	3,16	5,54	$2,13^{a}$±2,23
R2(20 %)	0,00	0,78	1,13	3,14	5,52	$2,11^{a}$±2,23
R3(30 %)	0,00	0,77	1,11	3,12	5,50	$2,10^{a}$±2,22
Mean ±SD	$0,00^{a}$±0,00	$0,81^{b}$±0,05	$1,13^{c}$±0,01	$3,15^{d}$±0,03	$5,53^{e}$±0,03	

Note: Different superscripts indicate rows and columns indicate significant difference (P<0.05).

Based on analysis of variance, the results showed that there was no significant difference (P>0.05) in the percentage reduction in egg weight at concentration (R factor), but significantly different (P<0.05) in storage time (L factor). . There was no significant difference (P>0.05) in the interaction between factors R (environmental concentration) and L (storage time). Table 5 shows that although all treatments L0, L1, L2, L3 and L4 are significantly different (P<0.05), none of the treatments R0, R1, R2 and R3 are significantly different (P>0.05). Treatment interactions showed that the Moringa leaf solution could not maintain egg weight during storage. Egg shell porosity, relative humidity, and storage temperature all impact egg weight loss.

The room temperature during storage in this study was ±27–29°C, with relative humidity 70–80%. Yuwanta (2010), stated that eggs stored at 25°C and 70% relative humidity experience a weekly weight loss of 0.8 g. Egg weight can decrease by up to 2 g per week if stored at 30°C. The length of storage in this study had an impact on reducing the quality of egg weight, resulting in damage to the eggs. The longer the eggs are stored, the more egg weight is lost [13]. Even the tannin content of up to 30% in Moringa leaves is not ideal for coating egg shells, so it can prevent carbon dioxide and water from passing through the pores of duck eggs.

3.4. Degree of Acidity (pH of Eggs)

In the highest solution concentration treatment, the average degree of acidity (pH) during 28 days of storage was 7.26 for R0 (0% concentration) and 7.15, 7.08, and 6.93 for R1, R2, and R3. The pH value in the R0L4 treatment had the highest value (7.99), while the pH value in the R2L0 treatment had the lowest value (6.17). The average pH of the highest treatment shelf life was 7.78 at L4 (28 days), and respectively 7.23, 7.01, 6.90, and 6.60 at L3 (21 days), L2 (14 days), L1 (7 days), and L0 (0 days). The best treatment is R2L0

Table 4. Average degree of acidity (pH) of eggs with soaking time and Moringa leaf solution concentration

Solution Concentration	Storage Time					Mean±SD
	L0 (0 Day)	L1 (7 Days)	L2 (14 Days)	L3 (21 Days)	L4 (28 Days)	
R0 (0 %)	6,78	6,84	7,20	7,49	7,99	$7,26^{c}$±0,50
R1(10%)	6,74	6,89	7,05	7,18	7,89	$7,15^{b}$±0,44
R2(20 %)	6,17	7,11	7,10	7,33	7,70	$7,08^{b}$±0,56
R3(30 %)	6,71	6,76	6,68	6,93	7,56	$6,93^{a}$±0,36
Mean ±SD	$6,60^{a}$±0,29	$6,90^{b}$±0,15	$7,01^{c}$±0,23	$7,23^{d}$±0,24	$7,78^{e}$±0,19	

Note: Different superscripts indicate rows and columns indicate significant difference (P<0.05).

The results of the analysis of variance showed that there was a significant difference (P<0.05) in the solution concentration treatment (R factor) and a significant difference (P<0.05) in the storage time (L factor) on the degree of acidity of the eggs. The results were significantly different (P<0.05) when the R factor (solution concentration) and L factor (storage time) interacted. Table 6 shows significant differences (P<0.05) with treatments R0, R1, R2, and R3. In addition, R1 is significantly different (P<0.05) from R0 and R3, but not significantly different (P>0.05) from R2. Between R0, R1, and R2, R3 treatment was significantly different (P<0.05). The higher the Moringa leaf solution, the better the results compared to other treatments during 28 days of storage. Based on the results obtained, the pH of the eggs increased every week. Eggs that are stored for a long time become more acidic (pH). According to [14], the bicarbonate buffer system changes

due to the loss of CO2 through the pores of the egg shell, thereby increasing the pH of the egg during storage. According to [15], increasing pH also causes thinning of the albumen, thereby transferring H2O from the albumen to the egg yolk, thereby damaging the vittelin membrane. As a result, the pH of the egg becomes more alkaline. This is the same as the results of [12], revealed that for duck eggs with 0 days of storage, the pH of the eggs was 7.01, while for 7 days of storage the pH value of the eggs was 7.11. In this study, the administration of Moringa leaf solution and the storage time affected the pH of the eggs. On day 28, a 30% concentration was able to maintain egg pH up to 7.56, a 20% concentration was able to maintain egg pH up to 7.70, a 10% concentration was able to maintain egg pH as much as 7.89. Compared with the pH of eggs without concentration, it reached 7.99.

4. Conclusion

The concentration of Moringa leaf solution and storage time influence the quality of the egg white index (albumen), yolk index (yolk) and the degree of acidity (pH) in duck eggs. Treatment with a 30% Moringa leaf solution had better results for 28 days compared to treatment without soaking. Further research was carried out by soaking duck eggs in Moringa leaf solution with concentrations above 30% for various storage periods. It is recommended to carry out organoleptic and microbiological tests on duck eggs and compare them with storage carried out at cold temperatures.

References

[1] Agustina, N., Thohari, I., & Rosyidi, D. (2013). Evaluasi sifat putih telur ayam pasteurisasi ditinjau dari pH, kadar air, sifat emulsi dan daya kembang Angel Cake. *Jurnal Ilmu-Ilmu Peternakan, 23*(2), 6-13.

[2] Armayanti, A. K., Azmi M., Rijal, M.. (2020). Pengaruh Perendaman Telur Menggunakan Larutan Sabut Kelapa (*Cocos Nucifera*) Terhadap Kualitas Interior Telur Ayam Ras. *Jurnal Agrominansia*, 5(1).

[3] Novika, Z., Anwar D. M., & Mardiati, S. M. (2017). Kualitas Telur Itik setelah Perendaman dengan Ekstrak Daun Salam (*Syzygium polyantha*) dan disimpan pada Suhu 4ºC. *Buletin Anatomi dan Fisiologi, 2*(2).

[4] Rahmawati, S., T.R., Setyawati, & Yanti, A.P. (2014). Daya Simpan dan Kualitas Telur Ayam Ras Dilapisi Minyak Kelapa Kapur Sirih dan Ekstrak Etanol saraswatiKelopak Rosella. *Jurnal*. Fakultas Matematika dan Ilmu Pengetahuan Alam. Universitas Tanjungpura. Pontianak.

[5] Riawan., Riyanti., & Khaira, N. (2017). Pengaruh perendaman telur menggunakan larutan daun kelor terhadap kualitas internal telur ayam ras. *Jurnal Ilmiah Peternakan, 59*(1), 1-7.

[6] Rohyani, I.S., Eryanti, E., & Suripto. (2015). Kandungan Fitokimia Beberapa Jenis Tumbuhan Lokal yang Sering Dimanfaatkan Sebagai Bahan Baku Obat di Pulau Lombok. *Jurnal Fakultas Matematika dan Ilmu Pengetahuan Alam.* Universitas Mataram. Nusa Tenggara Barat.

[7] Tshabalala, T., Bhekumtheth, N., Ntakadzeni E.M., Trevor T. N., Hloniphani, P.M., Mbulisi, S., Ashwell ,R. N . (2019). *Scribbling the Cat: A Case of the "Miracle" Plant, Moringa oleifera. Plants 8*, 510.

[8] Putra, S. H. J. , & Tiring S. N. D. T. (2021). *The effectiveness of soaking Moringa leaves (Moringa oleifera L) on the internal quality of chicken eggs Gallus gallus domestica . Original Research Paper* : Jurnal Biologi Tropis .

[9] Putra, S. H. J. (2022). *Impact of Preservation Using Moringa (Moringa oleifera L.) Leaf Juice on Chicken (Gallus gallus domesticus) Egg White Index. Proceeding International Conference on Religion, Science and Education* (2022), *1*, 547-552.

[10] Mukhlisah, A. N., Maruddin, F., Faridah R., Hafid, A.,Irfan, A. (2021). *Quality test weight and pH of duck eggs using level treatment of melinjo leaves extract (Gnetum Gnemon Linn) and storage time. IOP Conference Series: Earth and Environmental Science*.

[11] Purdiyanto, J, & Slamet, R. (2018). Pengaruh Lama Simpan Telur Itik Terhadap Penurunan Berat, Indeks Kuning Telur (Ikt), Dan Haugh Unit (Hu). 3(1)

[12] Septiana, N., Riyanti, B., Khaira, N. (2015). Pengaruh Lama Simpan Dan Warna Kerabang Telur Itik Tegal Terhadap Indeks Albumen, Indeks Yolk, Dan Ph Telur. *Jurnal Ilmiah Peternakan Terpadu* Vol. 3(*1*): 81-86.

[13] Kurtini, T., Nova, K., & Septinova, D. (2014). Produksi Ternak Unggas. Edisi Revisi. Aura Printing. Bandar Lampung.

[14] Eddin, A. S., Ibrahim S. A.., & R. Tahergorabi. (2019). Egg quality and safety with an overview of edible coating application for egg preservation. *Food Chemistry*. *296*,29-39.

[15] Anas, M.Y.A., M. Wirapartha, & Okarini, I.A. (2021). Pengaruh pemanfaatan coating minyak zaitun dan minyak kelapa terhadap kualitas serta daya simpan telur ayam ras. *Jurnal Peternakan Tropika. 9*(1),177-88.