Quality Assessment of Silver Arabic Chicken Eggs with the Addition of Chitosan in Rations

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Quality Assessment of Silver Arabic Chicken Eggs with the Addition of Chitosan in Rations

Kajian Kualitas Internal Telur Ayam Arab Silverdengan Penambahan Kitosan dalam Ransum

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ABSTRAK

Kualitas telur ayam sangat dipengaruhi oleh nutrien ransum yang dikonsumsi. Kualitas telur bisa diamati dari eksternal dan internal telur. Ransum berpengaruh langsung terhadap kualitas baik eksternal maupun internal telur. Tujuan penelitian adalah ingin melihat pengaruh penambahan kitosan dalam ransum terhadap kualitas internal telur ayam. Penelitian menggunakan rancangan acak lengkap (RAL) dengan 6 perlakuan dan 5 ulangan, masing-masing ulangan terdiri dari dari 2 ekor ayam Arab umur 4,5 bulan. Penelitian dilakukan selama 7 minggu. Perlakuan yang diberikan adalah: R0 (Ransum Kontrol tanpa Kitosan), R1 (Ransum + Kitosan 0,5%), R2 (Ransum + Kitosan 1%), R3 (Ransum + Kitosan 1,5%), R4 (Ransum + Kitosan 2%), R5 (Ransum + Kitosan 2,5%). Parameter yang diukur adalah: haugh unit telur, indeks putih telur, bobot putih dan kuning telur. Hasil penelitian menunjukkan bahwa penambahan kitosan dalam ransum menunjukkan hasil yang sama (P > 0,05) terhadap nilai haugh unit, indeks putih telur, bobot putih dan kuning telur. Kesimpulan dari penelitian ini adalah pemberian kitosan dalam ransum belum memberi pengaruh terhadap kualitas internal telur ayam Arab Silver.

Kata kunci: ayam arab, kitosan, kualitas, telur

ABSTRACT

The quality of chicken eggs is greatly influenced by the nutrient ration consumed. Egg quality can be observed from the external and internal eggs. The ration directly affects the external and internal quality of the eggs. The research objective was to analyze the effect of chitosan addition in the ration on the internal quality of chicken eggs. The study used a completely randomized design (CRD) with 6 treatments and 5 replications, each replication consisting of 2 Silver Arabic Chickens aged 4.5 months. The study was conducted for 7 weeks. The treatments given were: R0 (control ration without chitosan), R1 (ration + chitosan 0.5%), R2 (ration + chitosan 1%), R3 (ration + chitosan 1.5%), R4 (ration + chitosan 2%), R5 (ration + chitosan 2.5%). The parameters were measured in haugh units, albumen index, albumen and yolk weight. The results demonstrate that the addition of chitosan in the ration showed the same results (P > 0.05) on the haugh unit

value, albumen index, albumen and yolk weight. The conclusion of this study indicates that the provision of chitosan in the ration has not had an effect on the internal quality of the Silver Arabic Chickens eggs.

Keywords: chitosan, eggs, silver arabic chickens, quality

INTRODUCTION

Chicken eggs are animal protein from poultry which is needed by the human body. This protein is needed for body builders, replace damaged cells, anti-body and messenger. In addition, eggs have more benefits than other food sources that have complete nutrition, easy to digest and absorb. Therefore, chicken eggs are needed by the human body. Provision of a ration in accordance with the proportion of protein and energy required is important for producing good quality eggs (Moran et al., 2019) it consists of yolk, albumen and covered by shells on the outside. The nutritional content in an egg consists of; carbohydrates 0.9%, fat 11.2%, protein 12.9%, and water 73.7%, and almost no fat content in egg whites (Abbas et al., 2021).

According to Widarta (2017), the protein content in albumen is 10.6% and in yolk is 16.6%. The material of an egg will directly affect the weight and size. In general, consumers tend to choose eggs with standard weight (average weight) and uniform size. To get the ideal egg weight, it is influenced by egg nutrients, especially protein. Albumen contains more than 50% protein, and also niacin, riboflavin, chlorine, magnesium, potassium, sodium and sulpur (Ramadhani et al., 2018).

If the protein content of the ration absorbed by the body is high, it will be circulated by the blood to the target organs that need it, such as for the formation of albumen and yolk in eggs. So that the albumen and yolk weights will also increase. (Tugiyanti & Iriyanti, 2012) states that the ovary is a place for yolk formation, if the yolk formation is less than perfect, the egg weight will be low. In addition, factors that can affect egg weight are age and genetic composition of livestock (Kususiyah et al., 2020).

The process of albumin and yolk synthesis depends on the effectiveness of nutrient absorption in the poultry body (Ipek & Sozcu, 2017). Therefore, the mass or weight of chicken eggs is largely determined by the breed of chicken, nutrition in the form of protein in the ration, and the age of the chicken (Necidová et al., 2019). Chitosan is a crustacean waste isolation product that can bind fat and act as enzyme immobilization. Chitosan is also often referred to as animal fiber. That is why, it is suitable to be given as a mixture of animal feed. Apart from seeds and disease control, the quality of poultry rations must be considered as a micro factor too. On suboptimal land with low soil fertility, it affects the potential and nutritional value of plants as raw material for poultry rations. Therefore, to improve the quality ofs the ration, it is necessary to add feed additives to the ration, such as chitosan. Feed additives are substances that are mixed in feed that can affect the health, productivity and nutritional status of livestock, even though these materials are not sufficient to meet nutritional needs.

Its function is expected to optimize the work of the digestive tract of chickens so that the metabolism runs optimally. The capability of chicken's body to absorb nutrients will greatly determine the internal quality of the egg. Internal quality indicators of an egg can be seen from the haugh unit value, albumen weight and yolk. The haugh unit value for fresh egg is 100. According to Habiburahman et al. (2020) that the high value of the Haugh unit is because the eggs are measured a maximum of 1 day after egg collection so that the eggs are still fresh. The main materials that make up albumen and yolk are protein and fat. Therefore, high protein intake in the body will increase the weight of albumen and yolk. Based on the description above, the

research objective was to study the role of chitosan in the ration on the internal quality of Silver Arabic chicken eggs.

MATERIALS AND METHODS

The study used 60 (sixty) female Silver Arabic chickens in the production phase. The chicken used was 4.5 months old. Chickens were kept in 30 units of battery cages. Each cage filled with 2 chickens. The cage was disinfected and equipped with lighting, feeding, watering and all other equipment.

The rations consisted of basal and treatment with the addition of chitosan. The treatment used pure chitosan from the Laboratory of Aquatic Product Technology of IPB. Prior to treatment, the samples were given a basal ration for 1 (one) week. The raw materials for the basal ration were fine bran, corn and concentrate. The ration was prepared with a crude protein content of 16.6% and metabolic energy of 2558.80 kcal/kg.

The composition of the raw materials for the ration was presented in Table 1, the nutrient content of the ration raw materials was presented in Table 2, and the nutrient content of the basal ration was presented in Table 3. The study used a completely randomized design (CRD) with 6 treatments and 5 replications, each replication consisted of 2 chickens. The treatments were: R0= control or without chitosan, R1= ration + chitosan 0.5%, R2= ration + chitosan 1%, R3= ration + chitosan 1.5%, R4= ration + chitosan 2%, R5= 2.5% ration + chitosan. The study was conducted for 7 weeks.

Eggs were collected every day and weighed. The sample was taken in the last week of the study. The parameters measured was:

1. Albumen index = $\frac{\text{T P (cm)}}{\text{1/2 LPT (cm)} + \text{PP (cm)}}$

Note: TP = albumen height, LP = albumen width, PP = albumen length

2. Albumen Weight

Measuring the weight of albumen was by separating the albumen and the yolk which was weighed by analytic scales.

3. Yolk Weights

Egg yolk was calculated to determine the average yolk weight in an egg by weighing the yolk using analytical scales.

4. Haugh Unit

The components for measuring HU were the measurement of albumen height and egg weight.

$HU = 100 \log (h + 7.57\text{-}1.7. W0.^{37})$

Note:
HU = haugh unit
h = albumen condensed height (mm)
W = egg weight (g)

Data Analysis

The data were analyzed with variance. If the treatment had a significant effect, then continued with Duncan's Multiple Range Test.

Table 1. The composition of ration

Ration Materials	Total (%)
Rice Bran	20
Corn	50
Concentrate	30

Table 2. The content of nutrient

Nutrient Content	Materials		
	Rice Bran *	Corn *	Concentrate**
Crude Protein (%)	12.00	8.60	33.00
Crude Fat (%)	13.00	3.90	2.00
Crude Fiber (%)	12.00	2.00	8.00
Calcium (%)	0.12	0.02	10.00
Phosphor (%)	0.20	0.10	0.50
Metabolic Energy (kcal/kg)	1630.00	3370.00	1826.22

Note: * Abun, 2007, ** PT Jafpa Comfeed Indonesia Tbk

Table 3. The nutrient content of basal rations

Nutritient Content	Total
Crude Protein (%)	16.60
Crude Fat (%)	5.15
Crude Fiber (%)	5.80
Calcium (%)	3.63
Phosphor (%)	0.24
Metabolic Energy (kcal / kg)	2558.80

Note: Calculated based on tables 2 and 3

Table 4. Effect of chitosan in the ration on the albumen weight

Variable	Treatments					
	R0	R1	R2	R3	R4	R5
Albumen Weight (g/grain)	18.28	18.72	18.12	18.40	18.90	18.70

Note: R0 (control ration without chitosan), R1 (ration + chitosan 0.5%), R2 (ration + chitosan 1%), R3 (ration + chitosan 1.5%), R4 (ration + chitosan 2%), R5 (ration + 2.5% chitosan)

Table 5. Effect of chitosan in the ration on the yolk weight

Variable	Treatments					
	R0	R1	R2	R3	R4	R5
Yolk Weight (g/egg)	11.60	13.60	13.02	12.60	13.72	14.30

Note: R0 (control ration without chitosan), R1 (ration + chitosan 0.5%), R2 (ration + chitosan 1%), R3 (ration + chitosan 1.5%), R4 (ration + chitosan 2%), R5 (ration + 2.5% chitosan)

RESULTS

The Effect of Chitosan on Internal Quality of Silver Arabic Chicken Eggs

Eggs that have good quality will extend the shelf life. Egg quality indicators could be seen from the outer and inner performance of the eggs. The results obtained from research on the internal quality of Silver Arabic chicken eggs which were influenced by albumen weight were presented in Table 4, yolk weight was presented in Table 5, albumen index was presented in Table 6 and the Haugh unit was presented in Table 7.

Based on the research conducted, the average result for 7 weeks of chitosan distribution in the ration had no significant effect on the quality of Silver Arabic chicken eggs ($P > 0.05$). Presented on Table 4,5,6 and 7 it could be seen that giving chitosan with a level of 0.5% to 2.5% in the ration gave the same albumen weight value ($P > 0.05$), which ranges from 18.12 g/grain to 18.90 g/grain. The average weight value of albumen obtained from the results of this study was 18.52 g/grain. The average weight of yolks showed a balanced value, ranging from 11.60 g/grain to 14.30 g/grain.

The same result was showed by the average 0.06 albumen index with values ranging from 0.05 to 0.07. The average of haugh unit values of this study were almost the same ($P > 0.05$), which ranged from 67.74 to 79.05. The average of haugh unit was 72.57 (Figure 1).

Table 6. Effect of chitosan in the ration on the albumen index

Variable	Treatments					
	R0	R1	R2	R3	R4	R5
Albumen Index	0.07	0.06	0.06	0.06	0.05	0.05

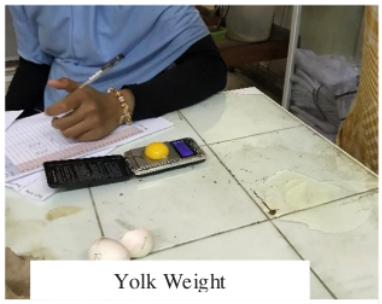
Note: R0 (control ration without chitosan), R1 (ration + chitosan 0.5%), R2 (ration + chitosan 1%), R3 (ration + chitosan 1.5%), R4 (ration + chitosan 2%), R5 (ration + 2.5% chitosan)

Table 7. Effect of chitosan in the ration on the haugh unit

Variable	Treatments					
	R0	R1	R2	R3	R4	R5
Haugh Unit	79.05	71.67	67.74	77.67	70.71	68.59

Note: R0 (control ration without chitosan), R1 (ration + chitosan 0.5%), R2 (ration + chitosan 1%), R3 (ration + chitosan 1.5%), R4 (ration + chitosan 2%), R5 (ration + 2.5% chitosan)

Albumen Weight



Yolk Weight

Albumen Index

Haugh Unit

Figure 1. Effect of chitosan in the ration on albumen ... haugh unit of arab chicken eggs

DISCUSSION

The Effect of Chitosan on Egg Internal Quality

The average weight of albumen shows the same value for all treatment. Chitosan added to the ration from a dose of 0.5% to 2.5% during the study period of 7 weeks did not show an effect on albumen weight. It is indicated that the addition of chitosan for the 7 weeks period of the study did not show the significance of protein retention in the body. The albumen weight is not significantly different. The nature of chitosan is predicted to shows an effect on the albumen weight gain in long term and more optimal effect on protein metabolism. This statement is based on the results of the in vitro study by Sahara et al. (2020) that chitosan at a dose of 1.5% is able to increase protein digestibility 11.20%, higher than the control. According to Argo et al. (2013) that ration protein will affect the viscosity which reflects the quality of the egg's interior.

The albumen index in this study shows an average that it is not significantly different among all treatments. Rations

composed of protein and energy iso during the study period of 7 weeks study, had not shown a significant impact, but there are indications that chitosan is able to increase protein digestibility in vitro tests (Sahara et al., 2020). If protein digestion increases then the egg protein content will increase, so that the albumen index also increases. albumen is made by different types of protein with different percentages. Examples of this are ovalbumin and ovomucin. Ovalbumin protein plays a role in gel formation when egg albumen is heated (Thohari et al., 2020).

Ovalbumin is a thick protein in albumen which is very important for the albumen index. It means that the thickness of the albumen is determined by ovalbumin. In addition, the thickness of the albumen is also determined by ovomucin as the builder of protein. The formation of ovumucin depends on the retention of amino acids or proteins in the body. It means that the higher the protein, the higher the formation of ovumucin, so that the albumen index is also higher. In addition, this is supported by (Liu et al., 2020) which states that the thickness or viscosity of eggs is influenced by the protein content contained in the ration given to poultry.

The results of research by Sahara et al. (2020) regarding the addition of chitosan in the ration with a dose increment of 0.5%–2.5% did not affect ration consumption ($P > 0.05$), so the intake of egg-forming protein is also the same. As another result, the albumen index shows the same outcomes. The albumen index value of Silver Arabic chickens' eggs in this study ranged from 0.05 to 0.07. So, the average albumen index value in this study is 0.06. The albumen index value in this study is still at the fresh albumen index standard. Lupu et al. (2016) stated that the fresh albumen index standard ranges from 0.050–0.174.

The weight of yolk with the addition of chitosan in the ration during the study period of 7 weeks also shows the same results. Based on the results of the analysis of the variance of giving chitosan in the ration, it is not significantly different ($P > 0.05$) on the increase in yolk weight. The average weight of yolk ranged from 11.60 to 14.30 grams/egg or with an average of 13.14 g/egg. The composition of yolk is predominantly constructed by fats, vitamins and minerals (Purba et al., 2018). Chitosan is a positive polycation which is very reactive to the negative ions around it.

Chitosan binds negatively charged fatty acids in the digestive tract so that it will reduce the fat absorbed (Sahara et al., 2020). In this condition, it is predicted that chitosan will bind negative ions to fatty acids and dispose of them through feces. As a result, it inhibits fat intake into the body. Thus, the fat content of the yolk in the ovaries remaining the same.

According to (Ismoyowati & Purwantini, 2013) stated that the high percentage of egg yolk weight can be caused by the protein content in the feed. Based on this statement, the weight of the Silver Arabic chicken yolk resulted from this study for all treatments is above the standard. Based on the results of the analysis of variance, the average haugh unit of Silver Arabic chicken eggs are also the same. Chitosan treatment for 7 weeks in the ration had not shown a significant effect. It is closely related to egg weight and albumen index. In this study, the weight of Silver Arabic chicken eggs produced are the same.

The reason is that the chitosan added to the ration did not significantly affect the chicken's appetite. Likewise, the albumen height represented by the albumen weight and index are also balanced (Table 4). This is in accordance with the opinion of Amin et al. (2015) and Djaelani (2017), that the factors which can affect the value of haugh units are high albumin, feed nutrition, protein intake, and egg weight. Eggs stored at low temperatures experienced a change in HU from 80 to 68 after 19 days, while without refrigeration experienced an average decrease of 1.51 units per day (Purwati et al., 2015). In this study, it shows that the haugh value of egg units

ranges from 67.738 to 79.046 with an average of 72.570. Haugh unit value in this study had very good quality or AA quality. Guided by the United States Department of Agriculture (2000), that the best level or with the title AA quality is haugh units above 72. Eggs with haugh units between 60 to 71 are categorized in A quality, and haugh units 31 to 59 are categorized as B. Therefore, based on the results obtained in this study, Chitosan had an indication of improving egg quality.

CONCLUSION

The addition of chitosan to the ration of Silver Arabic chickens in the production phase shows a balanced average value of haugh unit, albumen index, albumen and yolk weight. However, there are indications of an increase in the mean value of yolk weight parallel to the increase in the dose of chitosan in the ration.

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