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External and Internal Quality of the Quail Eggs Fed Ration with Different Level of Metabolizable Energy and Protein

Deden Sudrajat*, Dewi Wahyuni, Hanafi Nur, Dede Kardaya

Department of Animal Science, Faculty of Agriculture, University of Djuanda
Jl. Tol Ciawi 1 Kotak pos 35 Bogor, Indonesia

*Corresponding author: deden.sudrajat@unida.ac.id

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ABSTRACT

Quail eggs are a source of animal protein that the public can consume. In addition to the low price, eggs also contain nutrients needed by the body. So it is necessary to pay attention to the quality of the eggs before consuming them. Egg quality that can be assessed is derived from internal and external quality. The quality of the eggs is influenced by various factors, including the content of the ratio given, especially the energy-protein balance of the feed. This study aimed to assess the external and internal quality of quail eggs with different protein and energy levels. The research was carried out for 42 days in the poultry house of the Animal Husbandry Study Program, Faculty of Agriculture, Djuanda University. The feed ingredients formulated in this study as the basic ration were yellow corn, fine bran, soybean meal, fish meal, premix, DCP, CaCO3, CPO, and Cr-O. The design used was a completely randomized design (CRD) with four treatments and four replications with six quails per cage unit. The research data were analyzed by analysis of variance (ANOVA) if the data showed significantly different results ($P<0.05$), followed by Duncan's test. The variables observed in this study were egg weight, shell weight, percentage of eggshell weight, eggshell thickness, egg index, egg white weight, egg yolk weight, egg white weight percentage, egg yolk weight percentage, Haugh unit (HU). The results showed that the balance of energy and protein differences were not significantly different in all variables. Based on the research results, it can be concluded that the quail ration with the balance of protein 17% and metabolizable energy 2800 kcal/kg has been able to maintain the internal and external quality of eggs in quail and produce standard egg quality.

Keywords: protein energi balance; egg white, yolk, haugh unit

INTRODUCTION

Quail is one of the poultry that can produce eggs and meat. Quail is poultry that can be developed easly because quail is very easy to reared and can grow and develop quickly (Lestari et al. 2016). One type of quail can be kept in the Japanese quail (Coturnix coturnix japonica). Female quail can be used as seeds and quail egg producers. Laying quail for consumption are eggs that are not fertilized and produced by females. On the contrary, quail for quail-brooders are eggs that can be incubated and the eggs produced are fertilized (Panekanan et al., 2013). The national quail population continues to increase in 2019 to 14,107,479 quails (Ditjen PKH, 2019).

Eggs are a source of animal protein that the public can consume. In addition to the low price, eggs also contain nutrients needed by the body. So it is necessary to pay attention to the quality of the eggs before consuming them. Egg quality that can be assessed is derived from eggs' internal and external quality. External quality can be seen from the thickness of the shell, egg index, egg weight, while the internal quality can be seen from the percentage of egg white weight, egg yolk percentage, Haugh unit. The quality of the eggs is influenced by various factors,

including the content of the ration given at the time of rearing the quail. Besides affecting egg quality and production, feed is the most crucial in production costs because 60-80% of expenses are used as feed costs (Khalil 2015). This causes farmers to face difficulties in providing quality feed that can meet the nutritional needs of quail. It can be overcome this problem by determining the standard of quail nutrient needs, especially the energy-protein balance of feed.

Energy-protein balance is the most critical factor affecting feed quality and determining quail productivity (Napirah et al., 2018). Although the energy content of the feed is required to be balanced with the protein content of the feed, low protein feeds can decrease body weight (Kamran et al., 2008). In contrast, high protein feeds can increase quail body weight gain and internal quality in quail eggs (Kamran et al., 2008). Gheisari et al., 2011). Therefore, research on the provision of different energy and protein balances needs to be carried out in this study to improve quail eggs' external and internal quality. This study aims to assess the external and internal quality of quail eggs with different protein and energy levels.

MATERIAL AND METHOD

This research was carried out for 42 days in the Poultry house of the Department of Animal Science, Faculty of Agriculture, Djuanda University, Bogor. The tools and materials used in this study were 96 female quails aged 48 days with an initial weight of 151.43±6.81 g. The feed provided was self-mixing consisting of yellow corn, fine bran, soybean meal, fish meal, premix, DCP, $CaCO_3$, CPO, and Cr-O. The composition of the feed ingredients used as quail rations in this study can be seen in Table 1. The cage used was a battery cage where there were 16 cage plots.

The design used was a completely randomized design with four treatments, four replications, and each experimental unit consisted of 6 quails. The treatments carried out in this study were as follows: R1 = Crude Protein 17%, Metabolizable Energy 2800 kcal/kg. R2 = Crude Protein 18%, Metabolizable Energy 2950 kcal/kg. R3 = Crude Protein 19%, Metabolizable Energy 3000 kcal/kg. R4 = Crude Protein 20%, Metabolizable Energy 2900 kcal/kg. Data were analyzed using ANOVA with the help of the SPSS 25 application and further tested using Duncan Multiple Test.

The variables in this study were the external quality of eggs (egg weight, shell weight, shell thickness, and egg index) and internal egg quality (egg white weight percentage, egg yolk weight percentage, and Haugh units). The cages used for research were cleaned with a disinfectant solution. Feeding of 20 g/head/day given two times a day at 08.00 and 16.00, providing drinking water, cleaning of excreta , and sanitation around the cage. After that data collection, data was taken once a week for three weeks, carried out in the 3rd study week from the beginning of the study with 62 days of quail age until the fifth week of the study.

Table 1. Composition and nutrient content of experimental ration

No	Ingredients	Amount %			
		R1	R2	R3	R4
1	Yellow corn	63	63.5	62.5	62.0
2	Rice Bran	5,5	-	-	-
3	Soybean Meal	17.0	19.0	15.9	17.4
4	Fish meal	5,4	6.4	10	11.0
5	Premix	1.0	1.0	1.0	1.0
6	$CaCO_3$	5.0	5.0	5.0	5.0
7	CPO	0,5	2.5	3.0	1.5
8	DCP	2,5	2.5	2.5	2.0
9.	Cr-O	0,1	0.1	0.1	0.1
	Total	100	100	100	100
Nutrien					
Crude Protein (%)		17	18	19	20
Metabolizable Energy (Kkal/kg)		2800	2950	3000	2900

Note: CaCO3 (lime), CPO = Crude Palm Oil (oil), DCP = Dicalcium Phosphate, Cr-O = Organic Chromium.

RESULT AND DISCUSSION

The effect of energy and protein balance on quail eggs' external and internal quality can be seen in Tables 2 and 3. The results were not significantly different ($p>0.05$) on all variables.

There are three indicators to determining quail eggs' external quality: egg weight, egg index, and eggshell thickness. The weight of the eggs is essential to be considered because the heavier the eggs, the eggs tend to have a high economic value and are more attractive to consumers. A good egg index is needed for egg grading. At the same time, a suitable shell thickness will minimize the inside of the egg being contaminated with the environment so that the egg's contents have good quality. and stay awake (Nugraha et al., 2018).

The analysis of variance showed that the results were not significantly different ($P>0.05$) in egg weight. The average egg weight in this study was 8.99-9.99 g. This study is lower than Ardianyah et al. (2016), which provides different protein levels, namely 9.76-11.56 g. According to Parizidian et al. (2011), the egg weight ranged from 10-11.9 g or about 8% of the bodyweight of the parent. In the ratio, egg weight is influenced by genetics and protein (Sujana et al., 2020). The protein used differed from 17 to 20% of the dose in this study but did not give significantly different results. Therefore, it is suspected that the protein requirement of 17% has been met. Quail at laying eggs requires energy and protein for bare life, egg production, and growth. After the basic needs of life are met, the energy and protein consumed tend to be used for production rather than increasing egg weight (Sujana et al. 2020).

The shell is the outer egg structure that reduces physical and biological damage to the egg (Sujana et al. 2020). The average shell weight in this study ranged from 0.89-0.92 g. The thickness of the shell is one of the factors that affect egg quality because the shell can protect the contents of the egg. In addition, the thickness of the shell is much influenced by the level of calcium in the ratio, which determines the availability of calcium salts in the blood for egg formation (Yuwanta 2010). The average thickness of the shell in this study was 0.18-0.19 mm.

Means egg index was in the range of 78.10-79.40%. For comparison, research by Nugraha et al. (2018) produced an egg index of 77.62-78% in quail fed a ration containing 22% protein.

Table 2. Means external quality of eggs

treatment	Variabels			
	Egg Indeks (%)	Egg Weight (g)	Shell Weight (g)	Shell Thickness (mm)
R1	78,25 ± 1,45	8,99 ± 0,31	0,89 ± 0,02	0,18±0,008
R2	78,45 ± 1,36	9,21 ± 0,54	0,87 ± 0,35	0,18±0,007
R3	78,10 ± 1,21	9,29 ± 0,34	0,91 ± 0,45	0,18±0,008
R4	79,40 ± 0,65	9,99 ± 0,60	0,92 ± 0,40	0,19±0,003

Note: R1 = Crude Protein 17%, Metabolizable Energy 2800 kcal/kg, R2 = Crude Protein 18%, Metabolizable Energy 2950 kcal/kg, R3 = Crude Protein 19%, Metabolizable Energy 3000 kcal/kg, R4 = Crude Protein 20%, Metabolizable Energy 2900 kcal/kg.

Table 3. Means internal quality of quail eggs

Variabels	Treatments				
	R1	R2	R3	R4	Means
Egg white weight (g)	5.09 ± 0.23	4.93 ± 0.59	5.00 ± 0.35	5.63 ± 0.44	5.16 ± 0.47
Egg yolk (g)	2.71 ± 0.15	2.65 ± 0.32	2.57 ± 0.30	2.81 ± 0.28	2.69 ± 0.26
Egg white weight (%)	55.39 ± 0.64	54.54 ± 1.38	58.37 ± 6.05	57.07 ± 1.30	56.34 ± 3.24
Egg yolk (%)	30.32 ± 1.20	29.17 ± 0.96	28.61 ± 1.39	28.31 ± 1.60	29.10 ± 1.41
Haugh Unit	82.11 ± 1.39	84.04 ± 1.59	84.41 ± 0.52	84.83 ± 1.91	83.85 ± 1.68

Notes: R1 = Crude Protein 17%, Metabolizable Energy 2800 kcal/kg, R2 = Crude Protein 18%, Metabolizable Energy 2950 kcal/kg, R3 = Crude Protein 19%, Metabolizable Energy 3000 kcal/kg, R4 = Crude Protein 20%, Metabolizable Energy 2900 kcal/kg.

The statistical analysis results showed that the treatment was not significantly different (P>0.05) on egg white weight, egg yolk weight, egg white weight percentage, egg yolk weight percentage, and Haugh unit. These were thought to be caused because the protein content in the ration given to quail has met the need to achieve optimal egg weight (Agustini et al., 2014). According to Wahju (2004), egg quality is influenced by various factors, including genetic and environmental factors, nutrient content, environmental temperature, disease, age of poultry.

Means egg white weight ranged from 4.93-5.63 g or 54.54 -58.37%. Song et al. (2000) revealed that the standard weight of egg whites is approximately 61,2%. The results in this study showed that there was no significant difference (p>0.05) with the average egg yolk weight value being R1 2.71 g ± 0.15, R2 2.65 g ± 0.32, R3 2.57 g ± 0.30, R4 2.81 g ± 0.28. The mean for all treatments was 2.69 g ± 0.26. Although the results of this study had no effect (p>0.05), it was still included in the regular or good category, which was supported by Yuwanta (2010), who stated that the standard weight of quail egg yolks was 2.5-3.4 grams. In Nastiti et al. (2014) research with an average of 3.21 - 3.36 grams. The weight of quail egg yolk did not significantly affect this study due to the type of feed given. The level of consumption of quail feed was the same, and only differences in protein and energy metabolism levels in each treatment (Hanapis, 2020). Tugiyanti and Iriyanti (2012) suggested the influence of yolk weight on eggs, namely, ovarian development, poultry body weight, feed quality and quantity, age at sexual maturity, environment, and disease.

Means percentage value of egg white is R1 55.39±0.64%, R2 54.54±1.38%, R3 58.37±6.05%, R4 57.07±1.30 %. The mean of all treatments was 56.34± .24%. The average percentage value of egg yolk weight was R1 30.32±1.20%, R2 29.17± 0.96%, R3 28.61±1.39%, R4 28.31±1.60%. The mean of all treatments was 29.10±1.41%.

Egg white from eggs will decrease because the absorbed nutrients will form egg yolks first and then the formation of egg albumen. Therefore, if the yolk increases, the percentage in white will decrease (Dharmayanti et al., 2019). Furthermore, Suarjana et al. (2018) stated that the percentage of egg whites was negatively correlated with the percentage of yolks, i.e., when the percentage of whites decreased, the percentages of yolks increased. Suprijatna et al. (2005) reported that the egg-making process starts from the formation and release of the ovum (yolk) and then enters the infundibulum, which will immediately pass through the extended surface of the oviduct from the oviduct.

The results in this study showed that there was no significant difference (p>0.05) with the average value of the Haugh unit being R1 82.11±1.39, R2 84.04±1.59, R3 84.41±0.52, R4 84.83±1.91. The mean of all treatments was 83.85±1.68. The average of this study is lower than the results of research by Silaban et al. (2019), which used castor bean meal in the ration. The average Haugh unit value produced was 86.72 in control treatment. However, the HU value of the experimental eggs is included in the AAA quality category (HU value is more than 79) (USDA, 2004).

CONCLUSION

This study concluded that a ration with a protein balance of 17% and metabolizable energy of 2800 kcal/kg was able to maintain the internal and external quality of eggs in quail and produce standard egg quality.

CONFLICT OF INTEREST

There was no conflict of interest in this research with other parties, both individuals and organizations.

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