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Original Article

Potential of fermented rumen content of cow feed on daily egg productivity and quality of yolk color of quail egg (*Cortunix cortunix japonica*)

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ABSTRACT

The purpose of this study was to determine the effect of fermented rumen contents on quail rations. The parameters measured were daily egg production and egg yolk quality. There are 96 quails with 4 treatments and 6 repetitions. (T0) formulation feed without fermented rumen contents, (T1) formulation feed + 5% fermented rumen content, (T2) formulation feed + 10% fermented rumen content, (T3) formulation feed + 15% fermented rumen content. Samples are observed daily for daily egg production and the last week for egg yolk quality. The results showed that the uses of fermented rumen contents in rations at a rate of up to 15% causeddid not interfere towards daily egg production and could even improve the quality of egg yolk.

Keywords: Laserpuncture, male Japanese quail, weight gain, growth rate

Introduction

Increasing protein consumption for the community is important, especially for people who cannot afford to buy animal-based food which is generally relatively expensive. Diversification of animal-based protein consumption needs to be done to meet this need. Animal proteins that are cheap enough for the community to buy include quail meat and eggs (*Coturnix coturnix japonica*). As a food ingredient, quail eggs have better quality than chicken eggs, therefore increasing the production and quality of quail eggs for consumption needs to be done to support the needs and supply of animal-based protein that is affordable for the community (Mnisi *et al.*, 2021).

Judging from its physical composition, quail eggs consist of egg white (albumen) 47.4%, egg yolk (yolk) 31.9% and shell and shell membrane 20.7%. The protein content of quail eggs is around 13.1%, while the fat content is 11.1%. Quail egg yolk contains 15.7%-16.6% protein, 31.8%-35.5% fat, 0.2%-1.0% carbohydrates and 1.1% ash. Quail eggs contain 543 µg of vitamin A (per 100g) (Basri *et al.*, 2018). Egg quality is broadly divided into 2, external and internal. Egg yolk color is one of the internal qualities of eggs. The quality of egg yolk color affects consumer tastes, generally the preferred ones range from golden yellow to orange (Zurak *et al.*, 2022). The problem of egg quality in the form of less attractive egg yolks has caused quail breeders to experience a decrease in consumer interest. The quality of egg yolk color is one of the important factors that can determine egg quality. Eggs with good quality will produce a high selling price so that they can increase income with increasing consumer interest. Many things can be done to get eggs with good egg yolk color quality, one of which is by adding green

fodder that affects it. The fat and vitamin A content in feed will have a good effect on the structure of the egg yolk (Yuan *et al*., 2014).

Quail breeding factors that are also a problem for farmers are the relatively expensive feed costs. Feed is one of the main factors that is very important in the growth of quail livestock. Feed costs are the largest cost component that reaches 60-70% of the total cost of poultry production (Mallick *et al*., 2020). Efforts made to reduce these costs are to find substitute materials as alternative feed, where these materials are cheaper, are quite available, and do not compete with human needs. One alternative solution is to utilize the contents of the cow's rumen which only become livestock waste at the Slaughterhouse. The more the livestock business develops and the human need for livestock products, the more waste is produced.

The contents of the cow's rumen (IRS) contain nutrients that can be used as a source of energy because they contain metabolic energy of 2821.20 kcal / kg. The contents of the rumen also contain high levels of vitamin A and xanthophyll. Kojima *et al.* (2022) stated that high levels of vitamin A content in the form of xanthophyll carotene in feed can be used to improve the internal quality of the eggs produced, especially the color of the egg yolk. In the rumen of ruminant livestock there are also microbes, consisting of protozoa, bacteria and fungi (Cammack *et al*., 2018). One of the most important groups of bacteria in the rumen is cellulolytic bacteria. The cellulase enzyme produced by cellulolytic bacteria is able to break down cellulose so that ruminant livestock can live on low-quality forage (Russell and Wilson, 1996). The biodegradation process of materials containing cellulose is largely determined by the ability of cellulolytic microbes to produce cellulase enzymes that have high activity (Li *et al*., 2023).

In the rumen there is a population of bacteria belonging to the families Bacteriodes, Fusobacterium, Streptococcus, Eubacterium, Ruminococcus and Lactobacillus (Gilbert *et al*., 2020). Microbes in the rumen contents function to degrade the rumen contents that have not been completely degraded, this can be done in the fermentation process carried out in research drums. It is expected that the fermentation carried out in this study will be able to reduce the crude fiber content, increase the protein content which can later be used as one of the feed ingredients in making quail rations.

Materials and methods

Research design

The number of samples used in this study consisted of 96 quails aged 42 days divided into 4 feed treatments and 6 repetitions, each cage containing 4 quails. The research design used was a Completely Randomized Design (CRD). This research was conducted in Surabaya. The manufacture of fermented rumen feed for quails was carried out at the Animal Feed Laboratory, Faculty of Veterinary Medicine, Airlangga University, Surabaya. Examination of egg yolk color research materials was carried out at the Veterinary Public Health Laboratory, Faculty of Veterinary Medicine, Airlangga University, Surabaya. This research was conducted in mid-September-October 2019 for 4 weeks.

Treatment

Treatments studied:
P0 = Control, Formulated ration (0% fermented rumen content)
P1 = Formulated ration (5% fermented rumen content)
P2 = Formulated ration (10% fermented rumen content)
P3 = Formulated ration (15% fermented rumen content)

Formulation rations are composed using feed ingredients consisting of corn, bran, fish meal, karak, soybean meal, premik and vitamins with a crude protein content of 22% for layer quail. all research feeds are composed of isoprotein.

Preparation of feed making

The first step is to ferment the contents of the cow's rumen, by putting it in a drum to create anaerobic conditions and feeding it with bacteria

in the form of 1% molasses and 0.5% urea for 5 days. The second step is that the contents of the rumen must be dried. It happened at the Pegirian Surabaya RPH to be dried, and it took 2 days to dry. After that, an analysis of the fermented rumen content was carried out. The last step is to mix the fermented rumen contents with the quail ration.

Preparation of experimental animals or adaptation of cage and feed

Experimental animals were 96 quail (*Coturnix-coturnix japonica*). Before the study was conducted, the quail (*Coturnix-coturnix japonica*) were adapted to the conditions of the research location and feed for 7 days, the cages were placed in a ventilated and indirectly lit room according to the experimental environment in Surabaya.

One week before the cages were used, the cages were cleaned, whitewashed, and sprayed evenly with disinfectant, after which each cage compartment was given a base of used newspaper. The equipment for feeding and drinking water that will be used must be cleaned first (sterilized), then prepared in the cage. A 40 watt incandescent lamp was installed in the middle of each cage compartment. Measurement of cage temperature (20–25°C), cage humidity (30–80%).

Data analysis

The QDP data that has been obtained will be analyzed statistically using Analysis of Variance (ANOVA) to determine the significance of the average difference of the treatments given. If the results obtained are different or significantly different, then it is continued with the Duncan's Multiple Range Test with a level of 5% to determine the best treatment results. Statistical analysis using the SPSS 23.0 for Windows program.

For the data of egg yolk color quality that has been obtained, it will be analyzed statistically using the Kruskal Wallis Test to determine whether there is a significant difference between the independent variable group and its dependent variable. If the results are significantly different, it is continued with the Mann Whitney Test. Statistical analysis using the SPSS 23.0 for Windows program.

Result

Daily egg production of quail (Cortunix cortunix japonica)

Egg production data was calculated daily for 4 weeks of treatment using Quail Day Production (QDP), namely by dividing the number of eggs on the day in question by the number of quails alive on the same day multiplied by 100%. The average QDP value of each treatment can be seen in table 1

Table 1. Mean and standard deviation (SD) of quail day production

BAB I Treatment		**BAB II** ivity ± SD	Product
BAB III	P0	**BAB IV**	64.58[a] ± 3.90
BAB V	P1	**BAB VI**	65.18[a] ± 4.72
BAB VII	P2	**BAB VIII**	63.39[a] ± 2.65
BAB IX	P3	**BAB X**	63.84[a] ± 3.86

Note: The same a (superscript) notation in the same column indicates no significant difference ($p>0.05$)

Based on the results of the Quail Day Production data analysis written in table 1, the average value of each treatment ranged from 63.39% - 65.18% and there was no significant difference across treatments.

Quail Egg Yolk Color Quality (Cortunix cortunix japonica)

The parameters of the egg yolk color quality test observed include the level of egg yolk color score. Egg sampling was carried out for 7 days in the 4th week of treatment. The results of the examination of the quality of quail egg yolk using a yolk color fan showed that the contents of the rumen fermentation had a significant effect ($p <0.05$).

Table 2. Average value of egg yolk color quality

BAB XI Treatment		BAB XII	Egg yolk color quality
BAB XIII	P0	BAB XIV	3.50[a]
BAB XV	P1	BAB XVI	14.50 [b]
BAB XVII	P2	BAB XVIII	15.75 [b]
BAB XIX	P3	BAB XX	16.25 [b]

Note: The notation a and b (superscript) in the same column indicates a significant difference ($p<0.05$)

Based on table 2, it can be seen that the use of fermented rumen contents in quail rations of up to 15% can improve the quality of egg yolk color which is significantly different ($p<0.05$) from p0 (control), while P1, P2, and P3 do not show any significant differences ($p>0.05$).

Discussion

Daily egg production of quail (Cortunix cortunix japonica)

Fermented rumen contents are chosen because usually rumen contents only become livestock waste in the Slaughterhouse. In addition, it is also very easy to obtain and can be an additional alternative to quail rations. Because quail consumption is quite large and the price of feed is not cheap. In compiling rations, in addition to calculating the composition of the nutritional value of feed ingredients, the content of feed substances in each raw material must also be known, so that the lack of one nutrient can be covered by using other feed raw materials (Belkhanchi *et al*., 2023).

The average Quail Day Production (QDP) during 4 weeks of treatment in the Control Treatment given formulated feed without fermented rumen contents (P0), Treatment 1 given formulated feed plus 5% fermented rumen contents (P1), Treatment 2 given formulated feed plus 10% fermented rumen contents (P2), Treatment 3 given formulated feed plus 15% fermented rumen contents (P3), were respectively 64.59%; 65.18%; 63.39%; 63.84%.

The average results show that the use of rumen contents up to 15% did not show a significant difference in egg production ($p>0.05$). The absence of a significant difference is because all treatments use the same protein content of 20%, although the crude fiber increases due to fermentation in the rumen contents but is still within normal limits. The normal limit of crude fiber for layer phase quail is a maximum of 7%. So, seen from these data, the use of fermented rumen contents in rations composed of isoprotein with a dose of up to 15% does not have a significant effect, so it does not interfere with the productivity of the quail itself.

Quail Egg Yolk Color Quality (Cortunix cortunix japonica)

Calculation of the yellow color score using a yolk color fan which has 16 different colors. The addition of fermented rumen contents in the quail ration showed results that there were significant differences between the four treatments. The highest score sequence was from treatment 3 which was given formulated feed plus 15% fermented rumen contents (P3) with an average yolk color score of 16.25; treatment 2 which was given formulated feed plus 10% fermented rumen contents (P2) with an average of 14.50; treatment 1 which was given formulated feed plus 5% fermented rumen contents (P1) with an average value of 15.75; and the last control treatment which was given formulated feed without fermented rumen contents (P0) with an average value of 3.50.

The quality of egg yolk color was chosen as a parameter in this study because it is one of the important factors that can determine the quality of eggs from the many factors that can determine the quality of eggs. Eggs with good quality will produce a high selling price so that they can increase income with increasing consumer interest. The contents of the fermented rumen are classified as green plants, greens generally contain a lot of carotenoid compounds, carotenoid compounds are divided into two large groups, namely the carotene group and the xanthophyll group. Carotenoids are a group of compounds with long carbon chains (C40) and consist of various types (<600 molecules) that

are synthesized by plants. Carotenoid compounds usually give a yellow color to egg yolks. Nababan *et al*. (2022) in their study found that giving fermented papaya leaf greens to lohman strain chickens as much as 13% obtained a very good egg yolk color score with an average of 14.07.

As one example of greens consumed by cattle and is a source of carotene and xanthophyll is legume leaves, legume leaves have a high content of vitamin A sources with β-carotene and xanthophyll. Legume leaves of trees contain many phenolic compounds in high concentrations (Lin *et al*., 2016). The following are some of the carotene contents of legume leaves as stated by Tangendjaja and Wina (1993): Lamtoro (*Leucaena leucocephala*) of 536.6 mg total carotene/kg dry matter; Gamal (*Gliricidia sepium*) of 368.5 mg total carotene/kg dry matter; Kaliandra (*Caliandra calothyrsus*) of 327.8 mg total carotene/kg dry matter; Turi (*Sesbania grandiflora*) of 439.6 mg total carotene/kg dry matter. This shows that the content of fresh elephant grass that is usually consumed by cows only contains 182–221 mg of total carotene/kg dry matter, which is smaller than legume leaves. The higher the egg yolk color score, the better the quality of the egg (Sözcü *et al*., 2021).

Conclusion

Based on the results obtained from this study, it can be concluded that the use of fermented rumen contents with a dose of up to 15% in the ration does not affect daily egg production but improves the quality of quail egg yolk (*Cortunix cortunix japonica*).

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