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Original Article

The influence of using fermentated rumen content at quail feed to the protein of yolk and albumen of quail eggs

Gesa Cantya Primatara[1], Mohammad Anam Al-Arif[2*], Tita Damayanti Lestari[3], Widya Paramita Lokapirnasari[2], Sri Hidanah[2], Suharsono Suharsono[4]

[1]Profession Program of Veterinary Medicine, Faculty of Veterinary Medicine, Universitas Airlangga, Jl. Dr. Ir. H. Soekarno, Kampus C Mulyorejo, Surabaya 60115, East Java, Indonesia
[2]Division of Animal Husbandry, Faculty of Veterinary Medicine, Universitas Airlangga, Jl. Dr. Ir. H. Soekarno, Kampus C Mulyorejo, Surabaya 60115, East Java, Indonesia
[3]Division of Veterinary Reproduction, Faculty of Veterinary Medicine, Universitas Airlangga, Jl. Dr. Ir. H. Soekarno, Kampus C Mulyorejo, Surabaya 60115, East Java, Indonesia
[4]Division of Veterinary Anatomy, Faculty of Veterinary Medicine, Universitas Airlangga, Jl. Dr. Ir. H. Soekarno, Kampus C Mulyorejo, Surabaya 60115, East Java, Indonesia

ABSTRACT

Ruminal content is one of slaughterhouse waste that has not been utilized optimally, in fact there are cases where ruminal content are thrown away haphazardly, causing environmental pollution. The nutritional value of ruminal content is relatively high which is caused by the imperfect nutrition absorption do not have much difference with the original nutritional value coming from the cattle feed itself. nutritional value in ruminal content is 8.86% of protein, 2.6% of fat, 28.78% of fiber, 0.55% of phosphor, 18.54% of ash and 10.92% of water content. The aims of this research was to find out whether the usage of fermentation cattle ruminal content in quail's feed ransom can influence the protein content inside the yolk and albumen of an egg. This research used fermentation cattle ruminal content and divided into four treatments. The first treatment (T0) was only giving formula feed. The second treatment (T1) was Formulation feed (5% fermentated rumen content). The second treatment (T2) was Formulation feed (10% fermentated rumen content). The third treatment (T3) was Formulation feed (15% fermentated rumen content). The experiment design was Completely Randomized Design. The result was analysed using ANOVA with post hoc test Tukey HSD. Quail's egg of yolk protein content result were (T0) 12,934, (T1) 13,858, (T2) 13,792 and (T3) 13,801. Quail's egg albumen protein content result were (T0) 12,201, (P1) 10,930, (T2) 10,643 and (T3) 10,760. The result showed that using fermentation rumen content at quail feed give influence to protein of yolk and albumen in egg.

Keywords: Bontang city, traditional herbal medicine, medicinal plants, beef cattle, livestock healthcare

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***Corresponding Author:**
moh-a-a-a@fkh.unair.ac.id
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Introduction

Cattle waste is defined as unconsumed feed and associated bedding materials and animal carcasses from normal mortalities of livestock on a farm and it is major source of noxious gases, harmful pathogens and odor (Shakya *et al.*, 2022). Hence, it has public health and environmental concern. The waste involved in animal husbandry industry is waste collected from slaughterhouses and cattle product processing industry. It includes solid and liquid such as feces, urine, feed leftover, embryio, egg shells, fat, blood, hooves, bones, horns, and ruminal content (Ragrasi and Sabumon, 2023). Ruminal content is one of slaughterhouse waste that has not been utilized optimally, in fact there are cases where ruminal content are thrown away haphazardly, causing environmental pollution

(Mbuligwe and Kassenga, 2004). Ruminal content is slowly becoming an environmental problem due to its large quantity in which its production in 2012 alone reaches 240 million liters in Indonesia, coupled with sharp smell and high moisture content, which remained an obstacle in the effort of processing them.

The liquid portion of ruminal content as well as cattle feces still consist of high organic matter content (Henao *et al*., 2023). Ruminal content can be defined as unprocessed cattle feed in a ruminant's first stomach and it contained saliva, anaerobic microbes, cellulose, hemi-cellulose, protein, fat, carbohydrate, vitamin and mineral (Matthews *et al*., 2019).

The nutritional value of ruminal content is relatively high which is caused by the imperfect nutrition absorption do not have much difference with the original nutritional value coming from the cattle feed itself (Storm and Kristensen, 2010). Reynal and Broderick (2005) found that the nutritional value in ruminal content is 8.86% of protein, 2.6% of fat, 28.78% of fiber, 0.55% of phosphor, 18.54% of ash and 10.92% of water content. A ruminant's first stomach contains different kind of microorganisms, including protoza, bacteria and fungi (Cammack *et al*., 2018). One of the most vital bacterial compound inside a cattle's rumen is the cellulotic bacteria. All biodegradation process involving cellulose inside a rumen is highly determined by the cellulotic bacteria's ability to produce highly active cellulose enzyme (Weimer, 2022).

Ruminal content contains high fiber content and it cannot be digested by poultry, thus in order to use ruminal content as poultry feed, additional fermentation process is done using the naturally occuring microbes inside the rumen itself. The microbes in ruminal content can be used to further biodegrades the undigested matter in the ruminal content. The method used to process ruminal content can be done by substrate enriching process (fortification) and fermentation process (Parchami *et al*., 2023). These additional processing is done in order make dehydration process easier, fixing the texture and smell, as well as maintaining or even fortfying the nutritional content. Fermentation process can be done in an anaerobic container. Fermentation is done in order to reduce the fiber content and to increase its protein content that can be further processed as feed material in quail's feed ransom. According to Elfaki and Abdelatti (2016), the utilization of ruminal content as animal feed is limited to 10–15 percent of total feed formulation to prevent unwanted side effects.

Quails (*Coturnix coturnix japonica*) is quite a popular livestock commodity in Indonesia. One main strength of quail farming is its relatively fast growth (Nasrollah, 2008). Quails also produce eggs with a relatively high productivity. Quail's egg is a potential source for animal protein. Looking at its physical features, a quail's egg consist of 31.9% yolk, 47.4% albumen and 20.7% shell (Marliana *et al*., 2024). The protein content in a quail's egg is around 13.1% while its fat content is around 11.1%. Its yolk contains 15.7 – 16.6% protein, 31.8 – 35.5% fat, 0.2 – 1% carbohydrate and 1.1% ash.

Considering all these information, author is interested in using cattle's ruminal content as the source of protein of quail's feed formulation. The ruminal content will then be added to quail's feed. Author conjects that ruminal content can be used as feed material that will improve the overall protein content in quail's egg, both in its yolk and albumens.

Materials and methods

Research design

The number of samples used in this study was 96 quails aged 40-45 days which were divided into 4 feed treatments and 6 replications, each replication consisting of 4 quails. Fermentation of rumen cattle content fed to quails, is carried out in the Feed Laboratory of the Faculty of Veterinary Medicine, Airlangga University, Surabaya. Examination of egg white and egg white protein material was carried out at the Feed Laboratory of the Faculty of Veterinary Medicine, Airlangga University, Surabaya. This research was designed at the end of August 2019 for 4 weeks.

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Treatment

This research is an experimental study by conducting experiments on the fermentation of cattle rumen content in the feed to quails that are used as research samples. The research design pattern used in this study uses a completely randomized design (CRD). The experiment was carried out with four treatments and six repetitions. The treatment of this experiment:
T0 = Control, feed formulation (0% fermentated rumen content)
T1 = Formulation feed (5% fermentated rumen content)
T2 = Formulation feed (10% fermentated rumen content)
T3 = Formulation feed (15% fermentated rumen content)

Formulation feed prepared using ingredients - ingredients consisting of corn, rice brand, fish meal, soybean meal, premix and vitamins with 20% crude protein content for quails all research feed is composed of iso protein.

Feed production preparation

The first step is to ferment the rumen contents of cattle, by put them in a drum to make anaerobic conditions for 5 days. Before that, used urea and molasses for microbes nutrition during fermentation. Doses for urea is 0.5 miligrams and molases is 1 miligrams. The second step is the rumen content must be dried up. It taken place in RPH Pegirian Surabaya for dry in the sun, and took 2 days for dried up. After that is to analyze the rumen content fermented. The last step is mixing the rumen content fermented with quail ration.

Animal preparation

This experiments use 96 of quails (*Coturnix-coturnix japonica*). Before the study was conducted, quails (*Coturnix-coturnix japonica*) were adapted to site conditions for 7 days and fed for 7 days. During the adaptation of quail, will be given feed formulations without treatment, the quail are placed in a cage with a ventilation and in room temperature. Equipment for feed and drinking water must be cleaned first (sterilized), then prepared in a cage. Fourty watt incandescent lamps are installed in the center of each enclosure. keep the temperature of the cage (20-25°C), the humidity (30-80%).

Data analysis

The data that has been obtained will be analyzed statistically using Analysis of Variance (ANOVA) to find out the significance of the average difference in the treatment given. If different or significantly different results are obtained, then proceed with the Tukey's HSD with a level of 0,05 to find out the best treatment results (Kusriningrum, 2008). Statistical analysis using SPSS 26.0 for Windows.

Result

Yolk protein content

Table 1. Mean and Deviation Standart (DS) yolk protein egg content

Treatment	Yolk protein (%) ± Deviation Standart
T0	12.934% ± 0.557
T1	13.858% ± 0.785
T2	13.792% ± 0.709
T3	13.801% ± 0.693

The analysis result shown that yolk protein data in table 4.1 of T1, T2, T3 does not show significant difference with T0 (control).

Albumen protein content

Table 2. Mean and Deviation Standart (DS) albumen protein egg content

Treatment	Albumen protein ± Deviation Standart
T0	$12.201\%^{b}$ ± 0.650
T1	$10.930\%^{a}$ ± 0.487
T2	$10.643\%^{a}$ ± 0.172
T3	$10.760\%^{a}$ ± 0.313

Note: Notation a and b (superscript) in the same column show there is a significant (t<0.05)

The analysis result shown that albumen protein data in table 4.2 of T1, T2, T3 show significant difference with T0 (control) (t<0.05). T2 has the lowest yolk protein content compared

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to other treatments. It is known that the usage of rumen content fermentation to quail's ransom can decrease albumen protein compare with T0 (control) that only use feed formulation.

Discussion

Effect of trial in egg yolk protein

Analysis result shows that the addition of fermented ruminal content in sample T1, T2, and T3 does not show significant difference compared to sample T0 (control). The result of this treatments in T1, T2, and T3 are same as T0. Digestibility value is influenced by the ransom's ingredient and the amount of protein that goes into the digestinal system (Adhikari *et al*., 2022). The amount of crude fiber content in a ransom also influence its digestibility value, where as high crude fiber content will subsequently decrease digestibility value, which in turn decreases overall digestibility (Agyekum and Nyachoti, 2017).

Cholesterol and triglycerides are also component of the yolk or vitellogenin (Gul *et al*., 2021). Vitellogenin contains about 20% fat, mainly phospholipids, triglycerides, lipoprotein, and cholesterol (Dittmer *et al*., 2019). The components of fermented rumen content which is high in crude fiber can decreased fat and it will increase protein of yolk egg.

Albumen is a protein which synthesized, excreted, and accumulated in the epithelial cells and tubular gland cells in the magnum of the reproductive tract (Obianwuna *et al*., 2022). Then, the excreted protein in albumen is further secreted in yolk, so the protein in albumen goes to yolk for follicular nutrition (Yao *et al*., 2023). Egg yolk generally get its protein content albumen's excretion, while albumen get its protein content directly from the body (Santos *et al*., 2021). Thus, high crude fiber content in the quail's body will cause inefficient nutrition absorption. This coincides with Owens *et al.* (2010) statement where the crude fiber content inside a ransom directly influence digestibility and ransom with high crude fiber content will decrease digestibility value, which in turn decrease overall digestibility. This causes with fermented rumen content until 15% does not change the amount of protein in egg yolk compared to T0 (feed formulation).

Effect of trial in egg albumen protein

Analysis result of post hoc Tukey HSD shows that the addition of fermented ruminal content on sample T1 (5%), T2 (10%) and T3 (15%) does not show significant difference compared to T0 (control) ($t>0.05$). This is caused by the quail's nutritional absorption is different in each sample. Digestibility value of a ransom depends on the ingeredients and the amount of protein absorbed by the quail's digestive system (Adhikari *et al*., 2022). The amount of crude fiber content in a ransom will influence digestibility value, and high crude fiber content will decreases overall digestibility (Owens *et al*., 2010). The crude fiber content in each ransom is T0 (5.707), T1 (6.636), T2 (7.122) and T3 (7.608). This particularly high crude fiber content causes inefficient nutritional absorption in T1, T2 and T3 which in turn causes overall decrease of protein content in the albumen.

Albumen is a protein which is synthesized, excreted, and accumulated in the epithelial cells and tubular gland cells in the magnum of the reproductive tract (Obianwuna *et al*., 2022). Then, the excreted protein in albumen is further secreted into yolk to be used as follicular nutrition (Wong and Uni, 2021). Protein content in the albumen is directly obtained from the quail's body (Hu *et al*., 2016), which means the nutritional balance in the quail's body directly affects the formation of protein in the albumen. Thus, high crude fiber content in the quail's body will cause inefficient nutrition absorption. This coincides with Owens *et al.* (2010) statement where the crude fiber content inside a ransom directly influence digestibility and ransom with high crude fiber content will decrease digestibility value, which in turn decrease overall digestibility. This causes the protein content in the albumen in T1, T2 and T3 is lower than T0 (control). This particular metabolism process causes the decrease of protein in the albumen and an increase in protein content in the yolk.

Conclusion

Based on the research results, it can be concluded that providing 5-15% fermented rumen feed in quail feed does not cause changes in the protein content of quail egg yolks and reduces the protein content of quail egg whites.

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