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Research Article

Effect of Red Onion Skin Extract (*Allium cepa* L.) Supplementation in the Diet on the Performance of Laying Quails

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Abstract | This research aims to determine the best level of red onion skin extract (ROSE) as a replacement for synthetic antibiotic growth promoter (AGP) in the diet of laying quails. The laying quails (n=180) used in this study were 44 weeks old, with an average production of 55%. The experiment followed a completely randomized design, with three treatments: A (basal diet + Zinc bacitracin), B (basal diet + 1% ROSE), and C (basal diet + 2% ROSE). Each treatment was replicated six times. The observed variables were the *Escherichia coli* count of the intestine and the performance of laying quails (feed consumption, egg production, egg weight, egg mass, and feed conversion). The results showed that the inclusion of ROSE in the diet significantly ($p<0.05$) reduced the *Escherichia coli* population in the intestine as compared to the control group (group A). However, ROSE inclusion in the diet of laying quails had no ($p>0.05$) effect on the performance parameters. Therefore, 1 to 2% ROSE in the diet of laying quails can be used to replace with synthetic AGP.

Keywords | AGP, Red Onion Skin Extract, Laying quails, Feed consumption

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INTRODUCTION

Laying quails, one of the poultry species, are susceptible to stress and diseases, which can lead to a compromised immune system. Fluctuations in the immune system, combined with an unsupportive environment, can disrupt the intestinal bacterial balance in laying quails. The population of bacteria in the intestines plays a crucial role in maintaining digestive health. Suppose the people of pathogenic bacteria, such as *Escherichia coli* , exceed the permissible threshold in the intestines. In that case, it can result in health disorders and reduced egg-laying performance of the quails. To maintain the health and production performance of laying quails to remain optimal, efforts are needed to reduce the population of pathogenic bacteria in the intestines of laying quails, one of which can be done using antibiotic growth promoters (AGPs) (Ahmad et al., 2016; Liu et al., 2020; Li et al., 2018; Honorio-Javes et al., 2021). AGPs are antibiotics used in small quantities to stimulate growth, improve feed efficiency, enhance reproduction, and maintain animal health. AGPs play a role in increasing feed utilization efficiency by reducing the population of pathogenic bacteria in the digestive tract, thereby contributing to increased availability and absorption of nutrients from the feed, ultimately driving animal growth. However, using antibiotics or growth-promoting hormones at inappropriate doses can result in residues in animal products. Antibiotics commonly used in poultry feed include spiramycin, zinc bacitracin, tylosin, and virginiamycin. Nevertheless, the use of feed additives or synthetic antibiotics is currently prohibited in Indonesia by the Regulation of the Minister of Agriculture (No.14/PER-MENTAN/PK.350/5/2017), which regulates the classification of animal drugs. Antibiotic residues in animal products can pose risks to public health, such as bacterial resistance, allergies, resistance in gut flora, and toxicity. Additionally, residues can impact the environment and the economy.

One solution to address the issue of synthetic antibiotic residues in animal products is the use of natural AGPs. One potential feed additive is onion (*Allium cepa* L), particularly its outer skin. Onion is known for its diverse benefits, including its medicinal and antibiotic properties. The outer skin of the onion is preferred over its inner parts due to its higher phytochemical content (Škerget et al., 2009). Previous research has found that the addition of onion skin flour up to a level of 3% is not effective enough in improving the production performance of laying quails. This is because the addition of 3% affects the palatability of the feed due to its high fibre content. The fibre content in onion skin flour is 27.16% (Teru, 2017). The relatively high fibre content limits the use of onion skins in feed, thus limiting the intake of phytochemicals in onion skins. To optimize the utilization of phytochemicals by laying quails, simple processing is needed on onion skins before use, which can be quickly adopted by farmers. One method that can be used is extraction.

Extraction is separating a substance from a mixture using a suitable solvent. During extraction, active compounds dissolve in a solvent with appropriate polar properties. The solvent used should be capable of extracting the desired compounds without dissolving other materials. Factors influencing extraction outcomes include the extraction method, extraction duration (Kemit et al., 2016), and solvent type (Suryani et al., 2016). Onion skin is best extracted through maceration before being added to poultry feed. The best solvent type and maceration duration for removing onion skin are ethanol, with a 36-hour maceration period, containing phytochemical compounds like phenols, flavonoids, and alkaloids that can inhibit the growth of *Escherichia coli* bacteria (Fajri et al., 2020). Ethanol extracts from onion skin (*Allium cepa*) have shown activity against bacteria like *Escherichia coli*, *Pseudomonas fluoroscens*, *Staphylococcus aureus*, and *Bacillus cereus* (Octaviani et al., 2019; Škerget et al., 2009). Secondary metabolites found in onion skin include alkaloids, flavonoids, terpenoids, saponins, polyphenols, and quercetin, which have antimicrobial activity (Rahayu et al., 2015; Soemari, 2016). Fajri et al., (2020) states that the best type of solvent for extracting shallot skin is Ethanol with a maceration time of 36 hours with more phytochemical content, namely phenolics (+++++), flavonoids (++), alkaloids (++++), steroids (++) and triterpenoids (+). Furthermore, Setiani et al. (2017) stated that shallot skin extracted using ethanol contained 50.32% phenolics and 14.92% flavonoids.

However, there have been no reports on the use of onion skin extract in poultry feed. Therefore, the present study aims to investigate the effects of onion skin extract as a natural AGP in quail diets on the population of *Escherichia coli* bacteria in the intestines and the egg-laying performance of laying quails.

MATERIALS AND METHODS

Materials

The materials used in this research were red onion skin extract (ROSE) and various feed ingredients that composed the ration, including corn, rice bran, soybean meal, meat bone meal (MBM), corn gluten meal (CGM), rock flour, mineral B12, top mix, and synthetic antibiotics (Zinc bacitracin). The study involved laying quails that were 44 weeks old, with an average production rate of 55% out of 180 birds. The tools used in the study included 18 battery cages, feeding and drinking equipment, and digital scales.

Research Design

This research employed an experimental method, utilizing a Completely Randomized Design with three treatments and six replications. The treatments applied in the study were as follows: A = Basal ration + Zinc bacitracin Antibiotic (Control), B = Basal ration + 1% red onion skin extract (ROSE), C = Basal ration + 2% red onion skin extract (ROSE).

Total *Escherichia coli* count

The total count of *Escherichia coli* bacteria were observed after six weeks of treatment. One quail was randomly selected from each treatment group, slaughtered, and its small intestine was collected. The digestive fluid from the small intestine was collected and placed in a plastic cup, then stored in a cool box and transported to the laboratory for testing. The total colony count of *Escherichia coli* bacteria was determined using the method described by Purwati et al. (2005), following these procedures: First, all necessary equipment, such as Petri dishes, test tubes, Erlenmeyer flasks, and Eppendorf tubes, were sterilized by autoclaving at 121°C for 15 minutes at 15 lb pressure. The medium used was 37.46 grams of EMB agar dissolved in 1000 ml of distilled water, homogenized with a magnetic stirrer on a hot plate at 100°C, and sterilized in an autoclave.

Next, 1 gram of the sample was placed into a test tube containing 9 ml of 0.85% NaCl solution and vortexed until homogenized. This resulting solution was called a 10-1 dilution. A 100 µl portion of the dilution was transferred to the first Eppendorf tube containing 900 µl of 0.85% NaCl solution, vortexed until homogenized, and this was considered the 10-2 dilution. The process continued for dilutions up to 10-5. From dilutions 10-3, 10-4, and 10-5, 100 μl samples were streaked on Petri dishes containing EMB agar using a hockey stick. The Petri dishes were then incubated for 24 hours at 37°C before being coded to identify each sample. After 24 hours, colonies indicative of *Escherichia coli* were counted using a Quebec colony counter, and the total colonies of *Escherichia coli* enumerated as log CFU per gram of intestinal contents.

Evaluation of Production Performance

Feed consumption (g/head/day) was calculated once a week by reducing the amount of feed given by the amount of feed remaining at the end of the week and divided by the number of birds, divided by the maintenance period of 1 week (7 days). Daily egg production (%) was measured by comparing the number of eggs that day with the number of live quails and multiplied by 100%. Egg weight (g) was determined by weighing the eggs using a digital scale, the sum of all egg weights was divided by the number of eggs weighed in each treatment. Egg weighing was done every day. Egg mass (g/head/day) was calculated by means of daily egg production multiplied by the average daily egg weight. Feed conversion was calculated based on feed consumption (g/head/day) divided by egg mass (g/head/day).

Preparation of Red Onion Skin Extract (ROSE)

Red onion skin was extracted according to the Fajri et al. (2022) using a multi-stage maceration method. Macerated extraction of red onion skin flour was carried out by weighing 25 grams of red onion skin flour, and placing it into a 250 ml Erlenmeyer, then adding 250 ml of ethanol solvent. The ratio of red onion skin flour to solvent was 1:10. Next, it was macerated at room temperature for 36 hours, then filtered using filter paper (Extraction I). The filter residue was extracted again using ethanol solvent with a ratio of 1:5, and a second extraction was carried out for 36 hours. The filtrates obtained from the two extraction processes were evaporated using a rotary evaporator, to obtain red onion skin extract. The flow for making red onion skin extract can be seen in Figure 1.

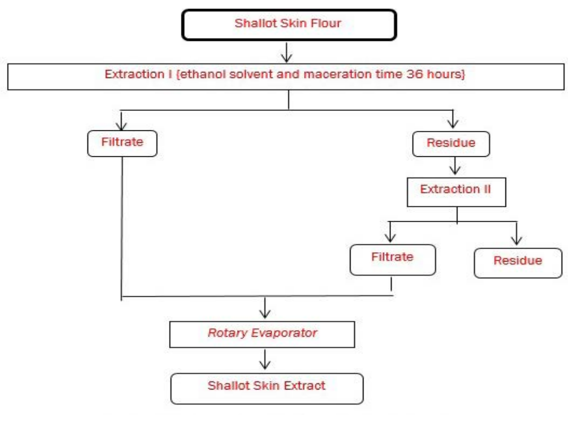

Figure 1: Flow of making red onion skin extract (Elberry et al., 2014)

Research Ration Preparation

The feed that was given to laying quails was a self-composed ration, an iso protein and iso energy, namely with a crude protein content of 20% and metabolic energy of 2800 kcal/kg (Djulardi, 2022). In this study, 2 types of rations were used, namely basal ration + zinc bacitracin antibiotic (control ration) and ration containing red onion skin extract (ROSE). The feed ingredients used to compose the ration were corn, rice bran, soybean meal, meat bone meal (MBM), corn gluten meal (CGM), rock flour, mineral B12 and top mix. The nutrient content of the ingredients for the rations can be seen in Table 1, and the composition of the research rations can be seen in Table 2.

Rearing of Laying Quail

Before treatment, laying quails were adapted to their ration for one week. After ration adaptation for one week, laying quails were given feed according to treatment. The feed was given daily at 07.00, and drinking water was provided *ad libitum*. Cages, places to eat, places to drink water and droppings were cleaned every day during the study. The feed given was weighed according to the needs of the laying quail. Leftover feed were collected once a week to calculate feed consumption. This study's rearing time for laying quail was 42 days (6 weeks).

Data analysis

To determine the effect of the treatment, the data obtained was analyzed by means of variance and if there were differences between the treatments it was continued with a test DMRT (Duncan's Multiple Range Test). The means were considered statistically significantly different when $p<0.05$.

RESULTS AND DISCUSSION

The Effect of Treatment on Total *Escherichia coli* Count in the Intestine (Log CFU/g)

The impact of treatments on the average total count of *Escherichia coli* bacteria in the intestines of laying quails (Log CFU/g) for each treatment throughout the study is presented in Table 3.

Table 3 shows that the average colonies of *Escherichia coli* bacteria in the intestines of laying quails for each treatment ranged from 0.33 to 3.15 Log CFU/g. The results of the analysis of variance indicated that the administration of ration red onion skin extract (ROSE) in the ration had a non significant effect ($p>0.05$) on the total colonies of *Escherichia coli* bacteria in the intestines of laying quails. This is because the administration of Zinc bacitracin antibiotics in treatment A and red onion skin extract (ROSE) in treatments B and C contain antibacterial compounds that can suppress the growth of pathogenic bacteria in the digestive tract of laying quails.

Table 1: Nutrient content (%) and metabolic energy (kcal/kg) of the feed ingredients that make up the research ration

Feed Ingredients	Crude Protein	Crude Fiber	Crude Fat	Ca	P	Met[a]	Lys[a]	Metabolizable Energy[a]
Corn[b]	8.58	2.91	3.80	0.06	0.01	0.20	0.20	3340
Rice Bran[b]	10.60	10.84	4.09	0.70	1.50	0.20	0.50	1900
Soybean meal[b]	40.07	2.73	1.71	0.70	0.31	0.70	3.20	2540
Meat Bone Meal[b]	43.81	3.96	0.96	8.00	3.11	0.70	3.60	2500
Corn Gluten Meal[b]	51.67	0.39	2.85	0.77	0.66	1.80	1.00	3770
Coconut Oil[b]	-	-	100	-	-	-	-	8600
Stone Flour[d]	-	-	-	38.0	0.17	-	-	-
B12 minerals[e]	-	-	-	32.0	15.0	-	-	-
Top Mix[f]	-	-	-	0.06	1.14	0.30	0.30	-

Note : a = Leeson and Summers (2001), b = (Montesqrit et al., 2020)
d = Khalil (2007), e = Label Kemasan Mineral B12, f = Medion (2006)

Table 2: Feed composition and nutrient content (%) and metabolic energy (kcal/kg) of study rations

Feed Ingredients	Ration Composition (%)		
	A	B	C
Corn	49.0	49.0	49.0
Rice Bran	8.0	8.0	8.0
Soybean meal	15.0	15.0	15.0
Meat Bone Meal	15.0	15.0	15.0
Corn Gluten Meal	4.5	4.5	4.5
Coconut Oil	1.0	1.0	1.0
Stone Flour	3.0	3.0	3.0
B12 minerals	4.0	4.0	4.0
Top Mix	0.5	0.5	0.5
Total	100	100	100
Zinc bacitrasin	0.21%	-	-
Red onion skin extract (ROSE)	-	1%	2%
	Content of Food Substances		
Crude Protein	19.96	19.96	19.96
Crude Fiber	3.31	3.31	3.31
Crude Fat	3.72	3.72	3.72
Calcium	4.53	4.53	4.53
Phosphor	1.24	1.24	1.24
Methionine	0.41	0.41	0.41
Lysin	1.20	1.20	1.20
Metabolizable Energy (Kcal/Kg)	2800	2800	2800

Note: In ration A, added Zinc bacitracin, ration B added 1% ROSE, ration C added 2% ROSE

Table 3: Mean total colonies of Escherichia coli bacteria in the intestines of laying quails (Log CFU/g) for each treatment during the study.

Treatment	Total *Escherichia coli* Bacteria (Log CFU/g)[ns]
A (Basal ration + Zinc bacitracin)	3.15[a]
B (Basal ration + red onion Skin Extract 1%)	0.50[b]
C (Basal ration + red onion Skin Extract 2%)	0.33[b]

SE	0.39

Superscripts in the same column indicate a highly significant difference (P>0.05)

Table 4: Mean consumption of laying quail rations (g/head/day) for each treatment during the study

Parameter	Treatment		
	A (Basal ration + Zinc bacitracin)	B (Basal ration + red onion skin extract (ROSE) 1%)	C (Basal ration + red onion skin extract (ROSE) 2%)
Feed consumption (g/head/day)^{ns}	23.31 ± 0.11	23.34 ± 0.07	23.12 ± 0.20
Quail Day Egg Production (%)	58.30 ± 1.88	55.77 ± 3.24	58.50 ± 2.68
Egg Weight (g/grain)^{ns}	11.16 ± 0.34	11.34 ± 0.24	11.15 ± 0.25
Egg Mass (g/head/day)^{ns}	6.54 ± 0.32	6.14 ± 0.38	6.54 ± 0.35
Feed Conversion^{ns}	3.77 ± 0.23	4.01 ± 0.22	3.72 ± 0.26

Zinc bacitracin antibiotic used in group A can affectively kill and inhibit the growth of pathogenic bacteria in the digestive tract. Zhu et al. (2019), stated that Zinc bacitracin, with its narrow spectrum antibiotic activity, works by inhibiting bacterial cell wall synthesis. Similarly, treatments B and C (given red onion skin extract (ROSE)) can kill and inhibit the growth of *Escherichia coli* bacteria due to the presence of phytochemical compounds in the red onion skin extract (ROSE) that act as antibacterials (Zhu et al., 2019).

The phytochemical compounds in ROSE, such as phenolics, flavonoids, alkaloids, steroids, and triterpenoids, contribute to their antibacterial properties. Phytochemical compounds such as terpenoids, phenolics, alkaloids, steroids, saponins, and flavonoids could inhibit the growth of *E. coli* bacteria (Julyasih & Purnawati, 2023). The phytochemical compounds in ROSE can effectively kill and inhibit the growth of *Escherichia coli* in the intestine of laying quails through different mechanisms of action.

Phenolic compounds damage the bacterial cell wall, leading to lysis or inhibiting the cell wall formation in growing cells. They also alter the permeability of the cytoplasmic membrane, causing leakage of nutrients from inside the cell. Furthermore, phenolic compounds denature cell proteins and disrupt the metabolic system by inhibiting intracellular enzymes (Peolengan et al., 2006). On the other hand, flavonoid compounds form complex extracellular compounds with dissolved proteins, damaging the bacterial cell membrane and releasing intracellular compounds (Darmawati et al., 2015).

Alkaloid compounds also act as antibacterial. Nikham, (2012) stated that alkaloids act as antibacterial through the inhibition of cell wall synthesis, leading to cell lysis and death. Wiyanto, (2010) mentioned that steroids damage the plasma membrane of bacterial cells, causing cytoplasm leakage and subsequent cell death. Each phytochemical compound's different mechanisms of action in ROSE contribute to the disruption of *Escherichia coli* growth. Likewise, ROSE was found effective for the inhibition of two pathogenic bacteria such as *Staphylococcus aureus* and *E. coli* and zone of inhibition was measured up to 12 mm (Masfria et al., 2019).

Our results indicates that the administration of ROSE in the ration of laying quails has more ability to inhibit the population of *E.coli* in the gut than synthetic antibiotic (Zinc bacitracin). From this study, it can be concluded that the administration of ROSE at a 1% level has the same effect as a 2% administration in replacing the role of synthetic antibiotics (Zinc bacitracin). This is likely because, at the 1% level, ROSE already contains sufficient phytochemical compounds to match the antibacterial role of Zinc bacitracin antibiotics. Although increasing the ROSE administration to a 2% level yields similar results as the 1% administration, it is believed that the difference in doses is too small to show a significant difference in the population of *Escherichia coli* bacteria in the intestines of laying quails. In this study, the total *Escherichia coli* count in the intestines of laying quails ranged from 2.36 to 2.79 Log CFU/g. These results are lower than the findings of (Elberry et al., 2014), who reported that the total count of *Escherichia coli* bacteria in the samples of intestines of laying quails ranged from 6.08 to 6.09 Log CFU/g when quails were given second wood extract and Sardines fish oil in their rations.

Effect of Treatment on Production Performance of Laying Quail

The effect of treatment on laying quail production performance in each treatment during the study can be seen in Table 4.

Feed consumption

Table 4 shows that the average ration consumption for laying quails in each treatment ranged from 23.12 to 23.34 g/head/day. The analysis of variance showed that the addition of ROSE in the ration had no significant effect (p>0.05) on feed consumption. This could be due to the administration of the antibiotic Zinc bacitracin in treatment A and the addition of red onion skin extract in treatments B and C, which contain antibacterial compounds that can suppress the growth of pathogenic bacteria in the digestive tract of laying quails.

The phytochemical compounds present in red onion skin extract function as antibacterial with different mechanisms of action. Phenolic compounds work by damaging the cell wall, resulting in lysis or inhibiting the cell wall formation process in growing cells, altering the permeability of the cytoplasmic membrane, causing nutrient leakage from inside the cell, denaturing cellular proteins, and disrupting metabolic systems within the cell by inhibiting the activity of intracellular enzymes (Peolengan et al., 2006). Furthermore, flavonoid compounds work by forming complexes with extracellular and soluble proteins, thus damaging the bacterial cell membrane and causing the release of intracellular compounds (Darmawati et al., 2015).

Wiyanto, (2010) stated that steroids act as antibacterial by damaging the bacterial cell plasma membrane, causing cytoplasm leakage and leading to cell death. Thus, these phytochemical compounds in the digestive tract of laying quails inhibit the growth of pathogenic bacteria and maintain the balance of gut microflora, ensuring the proper functioning of the quails' digestive system. Undisturbed digestion increases nutrient absorption, and ration utilization becomes more efficient. This aligns with Kamel (2001) who reported that plant extract containing antimicrobial compounds can improve ration utilization efficiency and aid in absorption in the digestive system.

In addition to their antibacterial function, the flavonoid compounds found in red onion skin extract also act as antioxidants. Red onion skin contains flavonoid compounds with potential as antioxidants that can prevent the development of free radicals in the body while repairing damaged body cells. The high content of flavonoids in red onion skin contributes to antioxidant effects and immune enhancement. Therefore, with increased immunity, ration utilization efficiency also improves because the energy required to capture free radicals and protect body cells from damage decreases, resulting in quails consuming less ration. Quails consume a diet to meet their energy needs, and once those needs are met, they will stop eating.

The nonsignificant difference between treatment A and treatments B and C indicates that the addition of ROSE in the ration for laying quails equals the ration consumption when synthetic AGP Zinc bacitracin is given without affecting palatability and ration consumption. Palatability is the degree of liking or preference of animals for the ration, which is closely related to ration consumption.

From this study, it can be concluded that adding ROSE at a 1% level has a similar effect to a 2% level in replacing the role of synthetic antibiotic (Zinc bacitracin). This is suspected to be because the 1% level already contains phytochemical compounds that are effective enough to equal the antibacterial role of Zinc bacitracin. Furthermore, although increasing the ROSE level to 2% would have the same effect as a 1% level, this may be due to the slight difference in dosage, which is not significant enough to affect the ration consumption of laying quails.

The diet consumption in this study ranged from 23.12 to 23.33 g/head/day. The ration consumption in this study is lower than the findings of Tribudi and Nufrianti (2017), who reported an average ration consumption for laying quails with the addition of *Centella asiatica* leaf powder ranging from 25.32 to 25.61 g/head/day. Furthermore, Widigdyo (2017) reported that the ration consumption for laying quails given Secang wood extract ranged from 24.38 to 24.51 g/head/day. However, the results of this study are higher than (Teru, 2017) findings, which stated that the ration consumption of 14-day-old laying quails fed red onion skin powder ranged from 21.42 to 21.45 g/head/day.

Quail Day Egg Production

As seen from Table 4, the average quail egg production for each treatment ranges between 55.77 - 58.50%. The analysis of variance results shows that the administration of ROSE in the feed does not have a significant effect ($p>0.05$) on the production of laying quail eggs. The lack of substantial impact of the treatment on egg production is due to the nearly identical feed consumption in each treatment. The same feed consumption results in relatively similar quail egg production. This can occur because egg production is influenced by feed consumption. Muslim et al. (2012) stated that feed consumption controls egg production. An increase in egg production occurs due to high feed consumption, so the amount of nutrients in the feed needed for egg formation will be more significant.

The egg production that does not significantly differ ($p>0.05$) is due to the same feed consumption in treatment A as in treatments B and C. This similar feed consumption is due to the administration of the antibiotic Zinc bacitracin in treatment A and the administration of ROSE in treatments B and C. Both of these substances contain antibacterial phytochemical compounds that can suppress the growth of pathogenic bacteria in the digestive tract of laying quails. Ziyu et al. (2019) stated that with its narrow-spectrum antibiotic activity, Zinc bacitracin inhibits bacterial cell wall synthesis. Li et al. (2000) said that Zinc bacitracin can increase the growth of Lactobacillus bacteria in the jejunum, thereby reducing the growth of pathogenic bacteria, which ultimately can support the egg formation process.

The ROSE given in treatments B and C can also kill and inhibit the growth of pathogenic bacteria in the digestive tract of laying quails. This is due to the phytochemical compounds in ROSE that act as antibacterial. These antibacterial compounds maintain gut microflora's balance and inhibit pathogenic bacteria's growth. Langhout (2000) stated that herbs and plant extracts work by stimulating the growth of beneficial bacteria and inhibiting the growth of pathogenic bacteria in the small intestine so that the work of the digestive tract is not disturbed. This results in increased nutrient absorption and increased egg production.

Egg production that does not significantly differ (p>0.05) indicates that the administration of ROSE at a 1% level has the same effect as the administration of 2% in replacing the role of synthetic antibiotics (Zinc bacitracin). This is suspected to be due to the phytochemical compounds at the 1% level that are effective enough to match the antibacterial role of Zinc bacitracin antibiotic. Even though increasing the administration of ROSE to a 2% level will have the same effect as a 1% administration level, this is suspected to occur due to a too-small dose difference, so it does not yet show a significant difference in the production of laying quail eggs. The relatively similar egg production is in line with the total *Escherichia coli* bacteria in the gut that are relatively the same between treatments. The exact total *Escherichia coli* bacteria indicate that the condition of the quail's digestive tract is relatively the same. Hence, the absorption of nutrients in quails in each treatment is relatively the same, causing the egg production to also be the same.

In this study, the egg production produced ranged between 55.77 - 58.50%. The results of this study are lower than those of Tribudi and Nufrianti (2017), which showed that the average production of laying quail eggs with the addition of gotu kola leaf flour ranged between 68.45 – 71.24%. Furthermore, Widigdyo (2017) stated that the production of laying quail eggs with the addition of secang wood extract ranged between 73.16 – 74.17%. Many factors, including age, lineage, food, management of maintenance, and disease influence the level of egg production.

Egg Weight

As seen from Table 4, the average weight of laying quail eggs for each treatment ranges between 11.15 – 11.34 g/egg. The analysis of variance results shows that the administration of ROSE in the feed does not have a significant effect (p>0.05) on the weight of laying quail eggs. The lack of significant impact of the treatment on egg weight is due to the relatively similar feed consumption in each treatment. The same feed consumption results in relatively equal quail egg weight. This can occur because egg weight is influenced by feed consumption, especially protein consumption. Djulardi (2006) stated that egg weight is greatly influenced by the protein contained in the feed. The higher the protein content in the feed, the more significant the increase in egg weight produced by the quail.

The ROSE given in treatments B and C can also kill and inhibit the growth of pathogenic bacteria in the digestive tract of laying quails (Asrori, 2019). This is due to the phytochemical compounds in ROSE that act as antibacterial. These phytochemical compounds include phenolics, flavonoids, alkaloids, steroids, and triterpenoids. These antibacterial compounds will maintain gut microflora's balance and inhibit pathogenic bacteria's growth. This results in increased nutrient absorption and increased egg production and weight.

The same egg weight in treatment A as in treatments B and C indicates that the administration of ROSE in laying quail feed can replace the role of synthetic AGP such as Zinc bacitracin. The results of this study are in line with Pasaribu et al. (2005) that the administration of dried aloe vera bioactive at a concentration of 1.0 g/kg has the same effect as the administration of the antibiotic Zinc bacitracin on egg weight.

The egg weight in this study ranged between 11.15 – 11.34 g/egg. This result is higher compared to the survey by Asrori (2019), who noted that the importance of quail eggs with the addition of papaya leaf flour ranged between 10.52 – 10.96 g/egg and 9.42-10.33 g/egg reported by (Reski et al., 2023).

Egg Mass

Table 4 shows that the average egg mass of laying quails for each treatment ranges between 6.14 – 6.54 g/bird/day. The results of the variance analysis show that the administration of ROSE in the feed does not have a significant effect (p>0.05) on the egg mass of laying quails. The lack of substantial effect of the treatment on egg mass is because the egg production and egg weight produced in this study also do not significantly affect it. This is in line with North and Bell (1992) who stated that egg mass is closely related to egg weight and production. Maknun et al. (2015) added that egg production and weight will affect the egg mass produced.

The egg mass that does not significantly differ (p>0.05) between treatments A and, B and C is also due to the relatively similar feed consumption, especially protein consumption, in each treatment. Novak et al. (2006) stated that protein consumption in feed affects the value of the egg mass produced. The same feed consumption, especially protein consumption, is due to the administration of the antibiotic Zinc bacitracin in treatment A and the administration of ROSE in treatments B and C. Both of these substances contain antibacterial phytochemical compounds that can suppress the growth of pathogenic bacteria in the digestive tract of laying quails who stated that Zinc bacitracin, with its narrow spectrum antibiotic activity, works by inhibiting bacterial cell wall synthesis (Zhu et al., 2019).

The egg mass in this study ranged between 6.14 – 6.54 g/bird/day. This result is lower compared to the study by Widigdyo (2017), which stated that the egg mass of laying quails given secang wood extract ranged between 7.23 – 7.39 g/bird/day.

Feed Conversion

Table 4 shows that the average feed conversion ratio of laying quails for each treatment ranges between 3.77 - 4.01. The results of the variance analysis show that the administration of ROSE in the feed does not have a significant effect ($p>0.05$) on the feed conversion ratio of laying quails. This is due to the relatively similar consumption and egg mass produced in this study. This is in line with Maknun et al. (2015), who stated that feed consumption and egg mass influence the feed conversion ratio, so if there is an increase between the two, the feed conversion ratio will remain balanced.

The insignificant difference in feed conversion ratio between treatment A and treatments B and C indicates that the administration of ROSE in laying quail feed has the same efficiency as synthetic antibiotics in utilizing feed for living and producing eggs. Therefore, the administration of ROSE in laying quail feed can replace the role of artificial AGP such as Zinc bacitracin. This can occur because administering the antibiotic Zinc bacitracin in treatment A and ROSE in treatments B and C contains antibacterial compounds that can suppress the growth of pathogenic bacteria in the digestive tract of laying quails.

The feed conversion ratio in this study ranged between 3.77 - 4.01. This result is lower than the study by (Berliana et al., 2018), which stated that the feed conversion ratio of laying quails given garlic powder and black onion powder ranged between 3.87 - 4.15. And the feed conversion ratio in this study is higher than the study by Widigdyo (2017), which stated that the feed conversion ratio of laying quails ranged between 3.32 and 3.38 when quails were given secang wood extract.

CONCLUSION

Based on the results of the study, it can be concluded that the administration of red onion skin extract (ROSE) in feed can replace the synthetic AGP, namely zinc bacitracin, without affecting intestinal *Escherichia coli* population and the production performance of laying quails.

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CONFLICT OF INTEREST

The authors have not made any declarations regarding potential conflicts of interest.

NOVELTY STATEMENT

The red onion skin extract (ROSE) can be utilized as a substitute material for AGP in quail feed, an area that has not been previously researched.

AUTHOR'S CONTRIBUTION

The article's authors all contributed to its experiment and writing. Together with Montesqrit, Harnentis, Sepri Reski, and Fadhli Fajri, they have made preparations beginning with research hypotheses, study ideas, and data gathering and processing. Additionally, all authors have agreed to submit this article to the Journal of Animal Health and Production.

REFERENCES

Ahmad A., Abid H., Waheed S., Tarar O. M., Zahra Y., Tehmina S., Ali T. M. (2016). Effects of replacing antibiotic growth promoters (agps) with botanical extracts and oils in feed of laying hens on production, performance and some microbial counts in feces. J. Anim. Plant Sci., 26(4): 893–900.

Asrori M. F. (2019). Pengaruh pemberian tepung daun pepaya dalam ransum terhadap produksi dan kadar kolesterol kuning telur burung puyuh [Skripsi]. Fakultas Peternakan. Universitas Nusantara PGRI Kediri.

Berliana B., Nurhayati N., Nelwida N. (2018). Substitusi Tepung Bawang Putih (*Allium sativum*) dengan Bawang Hitam (Black Garlic) dalam Ransum terhadap Umur Bertelur dan Bobot Telur Pertama Puyuh (Coturnix—Coturnix japonica). J. Agripet., 18(2): 95–102. https://doi.org/10.17969/agripet.v18i2.12779

Darmawati A., Bawa I., Suirta I. W. (2015). Isolasi dan Identifikasi Senyawa Golongan Flavonoid pada Daun

Nangka (Artocarpus heterophyllus Lmk) dan Aktivitas Antibakteri terhadap Bakteri *Staphylococcus aureus*. J. Kimia., 9(2): 203–210.

Djulardi A. (2022). Nutrisi Puyuh Konsep dan Aplikasinya: Vol. cetakan pertama. Minangkabau Press.

Elberry A. A., Mufti S., Al-Maghrabi J., Abdel Sattar E., Ghareib S. A., Mosli H. A., Gabr S. A. (2014). Immunomodulatory Effect of Red Onion (*Allium cepa* Linn) Scale Extract on Experimentally Induced Atypical Prostatic Hyperplasia in Wistar Rats. Mediat. Inflammat., 1–13. https://doi.org/10.1155/2014/640746

Fajri F., Montesqrit M., Harnentis H. (2020). Effect of solvent type and maceration time on phytochemical contents, yield precentage and antibacterial activity of red onion skin (*Allium cepa* l.) extract. Quest J., 8(6): 34–39.

Honorio-Javes C. E., Vallenas-Sánche, Y., Bazán Pérez J. T. (2021). Bacteriophage cocktail as a substitute for antibiotic-type growth promoters in poultry. Scient. Agropecuar., 12(4): 499–508. https://doi.org/10.17268/sci.agropecu.2021.054

Julyasih K. S. M., Purnawati A. (2023). Phytochemical Compounds and Antibacterial Activity to Escherichia coli of Green Macro Algae. IOP Conference Series: Earth Environ. Sci., 1131(1): 012012. https://doi.org/10.1088/1755-1315/1131/1/012012

Kamel C. (2001). Tracing modes of action and the roles of plants extracts in non ruminants. Dalam : P. C. Garnsworthy and J. Wiseman. Nottingham (Editor). Animal Nutrition. University Press, Nottingham.

Kemit N., Rai Widarta I. Wayan, Nocianitri K. Ayu. (2016). Pengaruh Jenis Pelarut Dan Waktu Maserasiterhadap Kandungan Senyawa Flavonoid Dan Aktivitas Antioksidan Ekstrak Daun Alpukat (Persea Americana Mill). J. Ilmu Dan Teknol. Pangan, 5(2): 130–141.

Khalil dan S. Anwar. (2007). Studi komposisi mineral tepung batu bukit kamang sebagai bahan baku pakan sumber mineral. Media Peternakan. 30 (1): 1825

Langhout P. (2000). New additives for broiler chicken. Feed Mix. Int. J. Feed, Nutrit. Technol. 9(6):24- 27

Lesson S., Dan J. D., Summers. (2001). Nutrition of the chicken. 4th Edition. Guelph. Ontario, Canada

Li X., Wu S., Li X., Yan T., Duan Y., Yang X., Duan Y., Sun Q., Yang X. (2018). Simultaneous Supplementation of Bacillus subtilis and Antibiotic Growth Promoters by Stages Improved Intestinal Function of Pullets by Altering Gut Microbiota. Front. Microbiol., 9: 2328. https://doi.org/10.3389/fmicb.2018.02328

Liu Y. L., Yan T., Li X. Y., Duan Y. L., Yang X., Yang X. J. (2020). Effects of *Bacillus subtilis* and antibiotic growth promoters on the growth performance, intestinal function and gut microbiota of pullets from 0 to 6 weeks. Animal., 14(8): 1619–1628. https://doi.org/10.1017/S1751731120000191

Maknun L., Sri K., Isna M. (2015). Performans produksi burung puyuh (coturnix coturnix japonica) dengan perlakuan tepung limbah penetasan telur puyuh. Jurnal Ilmu - ilmu Peternakan. 25 (3): 53-58.

Masfria, Haro G., Mierza V. (2019). Analysis Chemical Compounds And Antimicrobial Activity Of Red Onion (*Allium cepa* L.) Bulb Skin Extract. Rasayan J. Chem., *12*(02): 1002–1010. https://doi.org/10.31788/RJC.2019.1225153

Montesqrit M., Adly D., Harnentis H. (2020). Penambahan tepung daun mimba (Azadirachta indica A. juss) pada jagung pipilan yang terkontaminasi aflatoksin dan pengaruhnya terhadap performa produksi puyuh petelur. Prosiding Seminar Nasional Lingkungan Lahan Basah., 5: 95–101.

Muslim M., Nuraini N., Mirzah M. (2012). Pengaruh pemberian campuran dedak dan ampas tahu fermentasi dengan Monascus purpureus terhadap performa burung puyuh. J. Peternakan. 9 :15-26.

Nikham B. (2012). Uji bahan baku antibakteri dari buah mahkota dewa (phaleria macrocarpa (scheff) boerl.) hasil iradiasi gamma dan antibiotik terhadap bakteri patogen. Prosiding Pertemuan Ilmiah Ilmu Pengetahuan dan Teknologi Bahan.

North M. O., Bell D.D. (1992). Commercial chicken production manual. 4th Edition. An AVI Book Published by Van Nostrand Reinhold, New York

Novak C. H. M., Yakout Y., Scheideler S. E. (2006). The effect of dietary protein level and total sulfur amino acid: Lysine ratio on egg production parameters and egg yield in hy-line W-98 hens. Poult. Sci. 85: 2195-2206.

Octaviani M., Fadhli H., Yuneistya E. (2019). Uji Aktivitas Antimikroba Ekstrak Etanol dari Kulit Bawang Merah (*Allium cepa* L.) dengan Metode Difusi Cakram Antimicrobial Activity of Ethanol Extract of Shallot (*Allium cepa* L.) Peels Using the Disc Diffusion Method *, Haiyul Fadhli, Erenda Yuneistya. Pharmaceut. Sci. Res. (PSR). 6(1): 62–68.

Pasaribu, T., Sinurat A.P., Rakhmani S.I.W. (2005). Pengaruh pemberian bioaktif lidah buaya (Aloe vera) dan antrakinon terhadap produktivitas ayam petelur. JITV. 10: 169-174

Poeloengan M., Chairul I., Komala S., Salmah S., Susan M.N. (2006). Aktivitas antibakteri dan fitokimia dari beberapa jenis tanaman obat. Prosiding Seminar Nasional Teknologi Peternakan dan Veteriner, Bogor.

Purwati E., Syukur S., Hidayat Z. (2005). *Lactobacillus sp.* Isolasi dari biovicophitomega sebagai probiotik. Proceeding Lembaga Ilmu Pengetahuan Indonesia, Jakarta.

Rahayu S., Nunung K., Vina A. (2015). Ekstraksi dan indentifikasi senyawa flavonoid dari limbah kulit bawang merah sebagai antioksi dan alami. Al Kimiya. Al Kimiya., 2(1): 1–8.

Reski S., Rusli R.K., Montesqrit., Mahata M.E. (2023). The effect of using fermentation product *Turbinaria murayana* seaweed in ration on the quality of quail eggs (*Coturnix coturnix japonica*) Adv. Anim. Vet. Sci. 11(3): 453-458. https://dx.doi.org/10.17582/journal.aavs/2023/11.3.453.458

Setiani L.A., Sari B.L., Indriani L., Jupersio. (2017). Penentuan kadar flavonoid ekstrak etanol 70% kulitbawang merah (*Allium cepa* l.) dengan metode maserasi dan MAE (microwave assisted extraction). Fitofarmaka. 7 (2) : 15-22.

Škerget M., Mahjenie L., Bezjak M., Knez Z. (2009). Antioxidant, Radical Scavenging and Antimicrobial Activities of Red Onion (Allium cepa L) Skin and Edible Part Extracts. Chem. Biochem. Eng. Q., 23(4): 435–444.

Soemari Y.B. (2016). Uji Aktivitas antiinflamasi kuersetin kulit bawang merah (*Allium cepa* L.) pada mencit putih jantan (*Mus musculus*). J. Ilmiah Ibnu Sina, 1(2): 163–172.

Suryani N. C., Permana D. G. M., Jambe A. (2016). Pengaruh Jenis Pelarut Terhadap Kandungan Total Flavonoid Dan Aktivitas Antioksidan Ekstrak Daun Matoa (Pometia pinnata). J. Ilmu Dan Teknol. Pangan (ITEPA), 5(1).

Teru V. (2017). Pemanfaatan Tepung Kulit Bawang Merah (Allium Ascalonicum) Sebagai Imbuhan Pakan Terhadap Penampilan , Profil Darah Dan Kolesterol Pada Puyuh Petelur [Tesis]. Universitas Brawijaya.

Tribudi A.Y., Nurfianti A. (2017). Penambahan tepung daun pegagan (Centella asiatika) terhadap performa produksi puyuh. Jurnal Ilmu-Ilmu Peternakan. 27 (1): 96 – 100

Widigdyo A. (2017). Efek penambahan ekstrak kayu secang *(Caesalpinia sappan l.)* dan minyak ikan lemuru sebagai aditif pakan terhadap penampilan puyuh petelur. [Tesis]. Universitas Brawijaya.

Wiyanto D.B. (2010). UJI AKTIVITAS ANTIBAKTERI EKSTRAK RUMPUT LAUT Kappaphycus alvarezii DAN Eucheuma denticullatum TERHADAP BAKTERI Aeromonas hydrophila DAN Vibrio harveyii. J. KELAUTAN, Volume 3, No.1 April 2010 ISSN : 1907-9931. 3(1).

Zhu Z., Schnell L., Müller B., Müller M., Papatheodorou P., Barth H. (2019). The Antibiotic Bacitracin Protects Human Intestinal Epithelial Cells and Stem Cell-Derived Intestinal Organoids from *Clostridium difficile* Toxin TcdB. Stem Cells Int., 2019, 1–8. https://doi.org/10.1155/2019/4149762