Administration of *Zingiber zerumbet* extract on performances and haematological parameters of broiler chickens

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Abstract. Due to the prohibition of antibiotics administration as feed additives in animal production, nutritionists need to develop strategies as replacement of antibiotics in animal feed. Phytogenic which is considered as replacement of antibiotic has been used widely in animal feed to promote growth and improve animal health. This experiment aimed to evaluate the use of *Zingiber zerumbet* extract on performance [BW, FI, and FCR] and hematological parameters of broiler chicken. A number of 100 mixed-sex broiler chickens were randomly allocated according to various treatment groups. Each treatment was administrated different levels of *Z. zerumbet* extract [P1=control, P2=0.025% of *Z. zerumbet* extract in the water, P3=0.050 % of *Z. zerumbet* extract in the water, and P4=0.025% of *Z. zerumbet* extract in the water]. Chickens were provided commercial feed with a nutrient requirement for started and growers. Water and feed were supplied *ad libitum*. Parameter observed in this experiment was broiler performance including BW, FI, and FCE each week up to 4 weeks and hematological parameter. One-way analysis of variance [ANOVA] was applied to determine the statistical difference by using SPSS. The significant differences between treatment were stated [P≤0.05]. The results of the experiment indicated that the use of *Z. zerumbet* in the water was not significantly different [P≥0.05] on chicken performance [BW, FI, and FCE]. Administration of *Z. zerumbet* extract in the water did not influence [P≥0.05] hematological parameters of broiler [hemoglobin, erythrosine, and thrombosis]. In conclusion, *Z. zerumbet* can be used as alternatives to feed additives to replace antibiotics in animal production.

1. Introduction

Antibiotics known as growth promoters have been used in animal production for decades to enhance animal growth. Due to the adverse effects of antibiotics administration in animal feed such as antibiotic residues in animal products and bacterial resistances as a potential risk to humans, the administration of antibiotics as feed additives in animal feeds has been banned. European Union has prohibited to use antibiotics in animal feed since 1 January 2006 [EC No. 1831/200] and Indonesia since 1 January 2018 [article 16 No 14/2017]. Improving the amount of bacterial antibiotic resistance by the administration of antibiotics as feed additives have been reported [1]. Besides, antibiotic administration in animal feed resulted in antibiotic residues in the environment and animal feed [2].

Nutritionists need to develop strategies in replacement antibiotics in animal feed as growth promoters. There are several other alternatives as replacement of antibiotics that have been utilized to improve animal performance such as pro-prebiotics, synbiotics, acidifier, phytagenic [plant extract], organic acids, immunostimulants, and enzyme due to their ability to prohibit anti-microbial pathogen growth [3]. Some studies reported that the administration of other feed additives in feeding animals
was able to improve animal performance, animal health and also can produce safe animal products [milk, meat, and egg] [4], [5], [6]. Phytogenic [plant extract] has been applied as an alternative of feed additives due to its role as antiviral, antimicrobial endogenous enzyme secretion and appetite stimulation. Z. zerumbet is one of the herbs that contain 46 bioactive compounds such as monoterpenes, camphene, sabinene, citral zingiberene, and lavandulyl acetate which has the potency to be used as alternative feed additives [7]. Several studies by applying Z. zerumbet in animal feed have been conducted [8], [9], [10]. However, results are still not consistent. Therefore, more studies are still required to obtain consistent results by using different animals and some parameters as a comparison from previous studies.

2. Materials and methods

2.1. Animal and feeding

A study on chicken growth was conducted at a private enterprise farm in Banda Aceh. Blood sample analyses consisting of the parameter for erythrosine, thrombosis, hemoglobin, and hematocrit were carried out at Veterinary Faculty, Syiah Kuala University, Banda Aceh.

This experiment was carried out with 100 mixed-sex broiler chickens which were randomly placed based on four different treatments and five replications. Each unit cage consisted of five chickens [total 20 cages]. Each treatment was administrated different levels of Z. zerumbet extract [P1=control, P2=0.025% of Z. zerumbet extract in the water, P3=0.050 % of Z. zerumbet extract in the water, and P4=0.025% of Z. zerumbet extract in the water]. Broilers were fed with commercial feed for started and grower containing 24% crude protein and 3200 kcal/kg. Feed and water were provided ad libitum. The cages temperature was applied based on chicken age from 35°C at starter period and reduced periodically up to 24°C for the next 4 weeks.

At the end of the study, twenty broilers [one per each unit study] were selected for hematological measurement. Blood was drawn from brachial vein puncture and placed in nonheparinized tubes. The blood was centrifuged to separate serum from other compounds and kept for further analysis at 20°C. Hematological parameters including leukocyte, thrombosis, hemoglobin, erythrosine, and hematocrit were examined by using an auto hematologic analyzer [Model: BC-2800, Shenzen Mindray Biomedical Electronics, Germany].

2.2. Statistical Analysis

Data collected from this study were analyzed using one-way analysis and designed to completely randomized design [CRD] consisting of four treatments and five replications. All data were subjected to analyze by using SPSS software and expressed as mean±SEM. The differences between treatments were declared [P<0.05] by applying Duncan Multiple Range Test [11] and error bars from the figures represented as standard deviations.

3. Results and discussion

3.1. Broiler performance

The effect of Z. zerumbet extract from the first to the fourth week on the performance of broiler chickens is presented in figure 1. As shown in figure 1, performance parameters including BW [a], FI [b] and FCE [c], administered different levels of Z. zerumbet extract did not significantly differ from control [P>0.05]. The body weight of broiler chickens up to 4 [g±SEM] weeks was 1377 ± 84.71, 1473±74.65, 1380 ± 184.86, 1499 ± 132.43 for P0, P1, P2, and P3 respectively. As indicated in the figure, the bodyweight of broiler chickens linearly increased by age. The genetic factor of animals influenced body weight, in which our study in local chicken at the age of up to 1 month, the body weight was only around 200 g [6]. A study conducted [12] by feeding the broiler with black soldier fly defatted meal as diet, the weight of broiler chicken at the age of 24 d was from 1095g to 1227.89 g. Therefore, the result was in correlation with our previous research by using meat-type chickens.
Figure 1. The Effect of *Z. zerumbet* extract as phytogenic feed additives on body weight [a] feed intake [b] and feed conversion efficiency [c] of broiler chickens evaluated each week up to 4 weeks. P1=control, P2=0.025% of *Z. zerumbet* extract in the water, P3=0.050% of *Z. zerumbet* extract in the water, and P4=0.025% of *Z. zerumbet* extract in the water.

Our study shows that feed intake was not significantly different (P>0.05) among the levels of *Z. zerumbet* extract in water each week. Like body weight, the animals genetic influenced feed intake and also feed conversion efficiency. In our study, feed intake and FCR of broiler chickens up to 28 d were from 2016 g to 2134 g and from 1.43 to 1.47 for FI and FCR respectively. The FCR in our study was lower compared to the previously conducted study [13]. However, the calculation of performance in this study was measured up to 42 d.

Administration of different levels of *Z. zerumbet* extract was not significantly influenced by BW, FI, and FCR. The study conducted [14] using phytogenic [48 or 72 mg per kg] and antibiotic [10 mg avilamycin per kg] in the basal diet improved BW and FI of broiler at the age of 24 d. It is well known that phytochemicals can be used as feed additives due to their biological activities [15] and able to produce enzymes by stimulating digestive for improving animal digestibility [16].

A research carried out [10] applying extracted *Z. zerumbet* rhizome up to 6% in water also had no significant effect on BW, FI, and FCR of chickens. Many studies conducted by using alternative feed additives to replace the role of antibiotics in animal performance showed different results from one study and others. Environmental and animal conditions such as stress and comfortable surroundings during the study could also influence animal performance.
3.2. Haematological parameters

The haematological parameters of broiler chickens administrated by Z. zerumbet extract are summarized in Table 1. Haematological parameters can be used as an indicator for the health status of animals including physiological and pathological after animals were administered to feed additives. As shown in the table that there is no significant effect on haematological parameters of broiler supplied by Z. zerumbet extract in water and haematological parameter measured in this study was within the physiological range. This study showed different results compared to the previous [6] in which application of different feed additives in animal feed significantly affected \( P \leq 0.05 \) on haematological parameters including erythrosine, thrombosis and hemoglobin but not for haematocrit and leucocyte. The concentration of leucocyte in blood indicated the infection of the body [17].

| Haematological Parameters | P0  | P1  | P2  | P3  | \( \bar{X} \pm SE \) | \( P_{value} \) |
|---------------------------|-----|-----|-----|-----|-------------------|---------------|
| Erythrosine [10^6/μL]     | 2.92| 2.80| 3.51| 3.07| 3.08 ± 0.13       | 0.220         |
| Thrombosis [10^3/μL]      | 39.60| 42.80| 48.40| 41.20| 43.00 ± 2.89      | 0.756         |
| Haemoglobin [g/dL]        | 14.00| 16.20| 17.68| 15.44| 15.83 ± 0.50      | 0.405         |
| Haematocrit [%]           | 36.58| 34.32| 43.70| 38.42| 38.26 ± 1.74      | 0.276         |

\( P1=\text{control}, P2=0.025\% \text{ of Z. zerumbet extract in the water}, P3=0.050 \% \text{ of Z. zerumbet extract in the water}, \) and \( P4=0.025\% \text{ of Z. zerumbet extract in the water} \).

The study carried out [18] in which chickens substituted by thyme powder to replace antibiotics showed no significant effect on the leucocyte concentration in the blood plasma. But in our study, we did not measure the leucocyte concentration after treatments in the plasma of blood. Another study conducted [19] indicated that haematological parameters such as HCT, Hb, WBC, and RBC significantly increased compared to the control group. Anshari et al. [20] reported that supplementation of diets with various levels of *Azadirachta indica* dried leaf meal \([1.25, 2.5 \text{ and } 5.0 \text{ g leaf meal/kg of feed.}]\) as phytogenic feed additives were no deleterious effects on hematological parameters in chickens thus *A. indica* can be used as a replacement of antibiotics in animal feeds.

4. Conclusions

The results from our study concluded that Z. zerumbet extract can be used as an alternative to replace antibiotics as phytogenic feed additives in animal production. There was a tendency that the application of Z. zerumbet extract as feed additives improved animal performance despite statistically no significant difference \( P>0.05 \). No negative effect also found in haematological parameters by the administration of Z. zerumbet extract. Further research is required to be conducted by increasing the level of Z. zerumbet extract as feed additives both in water and in the feed.

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**Acknowledgments**
This study was funded by Universitas Syiah Kuala Grant under the Professorship scheme in 2019. Thanks to Nanda Riwa, Ilham, Rojaur Rafiqi, Ryanda and Afid for helping this research especially data collection. We would like also thanks to Zuraidawati at Clinical Laboratory, Veterinary Science Faculty, Universitas Syiah Kuala for haematological measurements.