Influence of *Syzygium cumini* extract as feed additives on performance and haematological parameters of commercial broiler chickens

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**Abstract.** Phytogenics have been widely used as alternative feed additives to replace antibiotics in animal production. The present study aims to evaluate inclusion of *S. cumini* extract as feed additives on performance and haematological parameters of commercial broiler chickens. A total of 100-day-old commercial chickens (mixed sex) were randomly allocated to four treatments with five replicates. Each treatment was administrated different level of *S. cumini* extract in the drinking water (P0=control, P1=0.25 g/l drinking water, P2=0.50 g/l drinking water and P3=1.0 g/l drinking water). Commercial diet was provided during experiment based on nutrition requirement for starter and grower. Water and feed were given *ad libitum*. Data were collected to measure broiler performances and haematological parameters. One way ANOVA was applied in this study and significantly different among treatments were stated (P≥0.05). The results indicated that inclusion of *S. cumini* extract as feed additives in drinking water did not significantly affected (P>0.05) on animal performances and haematological parameters of commercial broiler chickens. Therefore, it concluded that *S. cumini* extract can be applied as alternative feed additive due to no negative effects of the *S. cumini* extract on performances and haematological parameters.

1. **Introduction**
The discovery of antibiotics to improve animal growth led to utilize antibiotics as feed additives with sub-therapeutic doses in the feed formulation. In the livestock industries, antibiotics have become well-establish application due to its beneficial effects such as improving of animal growth, feed efficiency and inhibiting of micro-organisms growth without harmful to the host. However, the use of antibiotics in animal feed for long time led to accumulation of harmful residues in the products of animal for example milk, egg and meat. In addition, antibiotics administration in animal feed causes antibiotic resistance in microflora pathogen for human and animals [1], [2]. Therefore, it is very important to find other suitable alternative feed additives as replacement to antibiotics such as pre-probiotics, phytogenics, enzymes, organic acids and others [3]-[6]. Phytogenics is plant-based resources which has been widely used as one of alternative feed additives to improve the production of animals due to its natural antioxidant content.

There are several plant herbal extracts as feed additives have been explored by scientists to enhance animal health and production such as cinnamon, garlic, ginger, yucca, turmeric and others herbs.
These herbal extracts contain pivotal bioactive and metabolite compounds function as antioxidant and other functional properties that can be used by animals to modify metabolism process in the body for health and performance purpose. A review study Eevuri and Puttur [7] reported that administration of plant herbal extracts in animal diet positively influenced animal performances, carcass traits, biochemical and immune response of animals. Herbs such as cinnamon, peppermint, cloves nutmeg also contain antioxidant properties (polyphenols, flavonoids, and terpenoids) functioned to prevent oxidative stress and diseases [8], [9]. Samadi et al. [3] investigated several local potential herbs in Aceh province such as Vernonia amygdalina Del., Calotropis gigantean, Syzygium oleana, Syzygium cumini, L and concluded that all phytogenic can be used as feed additives due to its antimicrobial and antioxidant activities. The result of the study indicated that S. cumini, L was better plant extracts compared to other plant extracts. Therefore, we use the extract of S. cumini, L for our further growth study in broiler chickens. 

S. cumini has been widely used as medical herbs particularly in diabetic diseases due to its bioactive compound halting diastatic conversion from starch to sugar. Ayyanar and Subash-Babu [10] reported that S. cumini had pharmacological actions since it is rich the vast number of bioactive and metabolic compounds and free radical scavenging activities such as anthocyanins, glucoside, ellagic acid, isoquercetin, kaemferol, and myrecetin. Various in vitro and in vivo pharmacological experiments proved that S. cumini had beneficial health effects to reduce metabolic abnormalities [11]. Ruan et al. [12] reported that S. cumini leaves contained 610.32 ± 9.03 mg/g phenolic and 451.50 ± 9.85 mg/g flavonoid. The study of S.cumini in animal production as feed additives particularly in broiler was very limited. The aim of present study is to evaluate administration of S. cumini extract as feed additives on performance and haematological parameters of commercial broiler chickens.

2. Materials and methods

2.1. Animal and nutrition

The growth study was conducted at private community farm in Banda Aceh and haematological parameter analysis was carried out at Veterinary Faculty, Universitas Syiah Kuala, Banda Aceh.

One hundred one-d-old mixed commercial broilers (CP 707) were randomly allotted into the four groups based on treatments with five replications of five birds per group (total 20 unit cages). Each group of treatment was given different concentration of feed additives (S.cumini extract dissolved in drinking water) as follow; P0=control, P1= 0.25 g/L, P2= 0.50 g/L and P3= 0.50 g/L. The procures to produce S.cumini extract was described by Samadi et al. [4]. Initial BW each treatment at the commencement of study was 75.25±0.81, 74.40±0.68, 74.40±1.03 and 75.80±0.58 for P0, P1, P2 and P3 respectively. All chickens were raised in concrete floor pens (1 m x 1 m) covered with wood shavings. The temperature of cages for throughout the study was controlled from 35°C and gradually reduced up to 24°C. All animals were provided free access (ad libitum) in water and feed. All chickens were fed commercial diet (isonitrogenous and isoenergetic) to meet NRC [13] recommendations for starter and grower. Water consumption was recorded daily. While feed consumption and live weight gain were recorded weekly based on five chickens each experimental unit.

Twenty chickens from growth study (five birds for each treatment) at the age of 28 d were chosen for further analysis of haematological. Blood for each bird was collected by brachial vein puncture and placed in nonheparinized tubes. The blood was then centrifuged to obtain serum and stored at the temperature of 20°C for further haematological analysis using auto haematology analyser (Model: BC-2800, Shenzen Mindray Biomedical Electronics, Germany).

2.2. Statistical analysis

One way ANOVA was applied to analyses of data in determining the effect of treatment on performance and haematological parameters using SPSS. The data were presented as mean value and standard error mean. Completely randomized design was applied to measure variables in this study.
including performance (body weight, feed conversion efficiency, feed intake and water consumption) and haematological parameters with the following equation: $\text{Y}_{ij} = \mu + \alpha_i + \varepsilon_{ij}$. Difference between treatments were stated when ($P \leq 0.05$) and subsequently to a Duncan Multiple Range Test [14] to assess differences between all group treatments.

3. Results and discussion

3.1. Animal performance

The influence of *S. cumini* extract administration on broiler performance each week for 4 weeks of observation is presented in the Figure 1. As indication from the Figure 1, broiler chickens administrated with different concentrations of *S. cumini* did not significantly affect ($P>0.05$) on the performance of broiler including body weight (a), feed intake (b), feed conversion efficiency (c) and water consumption (d). The results of our results were similar to the research carried out by Lee et al. [15] inclusion of oregano essential oil (50 and 100 mg/kg) diet did not significantly effect of broiler performances. Different from research conducted by Giannenas et al. [16] broiler supplemented with 4 commercial herbal feed additives: Stresomix®TM (0.5 g/kg feed); Ayucee®TM (1.0 g/kg feed); Salcochek Pro®TM (1.0 g/kg feed) improve body weight gain (BWG) and tend to increase feed conversion ratio (FCR). In addition, mixture of different plant extracts (oregano, cinnamon, thyme, pepper, cayenne and citrus extract) increased body weight and the increase of body weight was in correlation with the high intake of feed by animals [17]. Furthermore, supplementation of mixture thymol and cinnamaldehyde in broiler diet up to 42 days increased body weight gain approximately 15% and the improve of animal performances was assumed due to beneficial alteration of intestinal microflora in the host animals [18].

Another report, the application of turmeric as feed additive in animal feed enhanced animal performance including BWG, FI and FCR [19]. In our study, administration of *S. cumini* up to 1.0 g/L did not influence all the performance parameters. This is probably due to environmental condition supporting animal performance during growth study or the low concentration of feed additives in the study. As aforementioned reports, the performance results by application of different herbals in animal feed varied from one study to other studies. Some studies indicated that herbs were able to enhance animal performance due to stimulation of feed intake, increase digestive enzyme secretion and immune response activation, while the other studies were not affected. As reported by Botsoglou et al. [20] in which broiler administrated 50 and 100 mg/kg oregano in the animal feed was not able to enhance animal performances. In our study, inclusion of *S. cumini* extract in drinking water did not significantly influenced feed intake, therefore body weight gain of broiler treated with *S. cumini* extract was not affected as well. Feed conversion ratio in this study was relatively good between 1.24 – 1.33 at the age of 21 d. This was similar to study conducted by Abo Omar et al. [21] supplementation of herbal extract 300 ml/m³ in drinking water had the FCR value of 1.26-1.36 at the age of 21 d.
Figure 1. The Effect of *S. cumini* extract supplementation on broiler performances consisting of body weight (a), feed intake (b), feed conversion efficiency (c) and water consumption (d) of commercial broiler chickens measured weekly up to 4 weeks (P0=control, P1= 0.25 g/L *S. cumini* extract in the drinking water, P2= 0.50 g/L of *S. cumini* extract in the drinking water, and P3= 1.0 g/L of *S. cumini* extract in the drinking water).

3.2. Haematological parameters

Health status of animals after feed additive treatment can be determined by the haematological parameter concentration in the blood whether supplementation of feed additives will alter haematological parameters of animal blood or not. Leucocyte concentration in the blood increased sharply after organism was infected [22] Hemoglobin functioned to transport oxygen in the animal tissue [23], while leucocyte and its differentials protect the body from infections by producing antibodies [24].
Table 1. The Effect of S. cumini extract supplementation on the haematological parameters of broiler chickens observed at 28 d (P0=control, P1= 0.25 g/L S. cumini extarct in the drinking water, P2= 0.50 g/L of S. cumini extarct in the drinking water, and P3= 1.0 g/L of S. cumini extarct in the drinking water).

| Haematological Parameter | P0    | P1    | P2    | P3    | X̅ ± SE | P value |
|--------------------------|-------|-------|-------|-------|--------|---------|
| Leukocyte (10^3/µL)      | 184,05| 183,12| 201,60| 189,50| 189,57 ± 4,15 | 0,386   |
| Erythrosine (10^6/µL)    | 3,11  | 3,04  | 3,47  | 3,19  | 3,20 ± 0,10    | 0,446   |
| Thrombosis (10^3/ µL)    | 15,25 | 16,40 | 16,00 | 20,20 | 16,96 ± 1,39   | 0,631   |
| Hemoglobin (g/dL)        | 12,73 | 12,60 | 14,58 | 12,96 | 13,22 ± 0,38   | 0,208   |
| Haematocrit (%)          | 40,75 | 41,30 | 47,06 | 41,86 | 42,74 ± 1,32   | 0,312   |

The effect of S. cumini extract administration on haematological parameters of broiler chickens measured at 28 d is presented in the Table 1. As shown in the Table 1, inclusion of S. cumini extract in drinking water did not significantly influenced (P>0.05) haematological parameters including leukocyte, erythrosine, thrombosis, hemoglobin and hematocrit. The results of our study were similar to the study conducted by Toghyani [23] supplementation of thyme powder as alternative feed additives in broiler feed had no effect on the concentration of leucocyte. In our study before, local chickens fed different kind of feed additives significantly influenced erythrosine, thrombosis and hemoglobin but not for leucocyte and hematocrit [3].

4. Conclusion
The results of this study concluded that inclusion of S. cumini extract applied as feed additives in drinking water did not significantly affected on the performances of animals and haematological blood parameters of commercial broiler chickens. However, S. cumini extract can be used as alternative feed additive due to no harmful effects of this feed additive on performances and haematological parameters. Further study by increasing the concentration of S. cumini extract either in the diet or drinking water should be conducted including to measures other supported parameters.

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