Performance and hematological profile of broiler chickens administered by ethanol extract of African leaves *(Vernonia amygdalina)*

Ilham Ilham[1,2], *I* Wahyudi [1], *S* Wajizah [1,2], *T* Hidayat [3], *Sugito* Sugito[4] and *Samadi* Samadi [1,2*]

[1]Department of Animal Science, Faculty of Agriculture, University Syiah Kuala, Banda Aceh, 23111, Indonesia
[2]Research Centre for Innovation and Feed Technology, Universitas Syiah Kuala, Darussalam Banda Aceh 23111, Indonesia
[3]Department of Animal and Poultry Science, College of Agriculture and Bioresources, University of Saskatchewan, 51 Campus Drive, Saskatoon, SK, S7N 5A8, Canada
[4]Faculty of Veterinary, University Syiah Kuala, Banda Aceh, 23111, Indonesia

Abstract. This research aims to determine the effect of using african leaf herbal feed ingredients *(Vernonia amygdalina)* as a feed additive on the performance and hematology profile of broiler chickens. A total of 100 DOC (MB90) broilers were randomly assigned to 20 cage units consisting of 4 treatments and 5 replications. In each treatment, African leaf extract was given in drinking water at different doses (A0 = control; A1 = 250 mg/L; A2 = 500 mg/L; and A3 = 750 mg/L). The feed used in this research is commercial feed for the DOC period up to the harvest period. Body weight and feed consumption are calculated weekly during the study (4 weeks). All data are recorded to determine the performance of broiler chickens, while sample blood collection for hematology tests is performed at the end study. Data were analysed by one-way ANOVA. Differences between treatments were stated if $P<0.05$. The results showed that giving African leaf extract as a feed additive had no effect ($P>0.05$) on the performance and hematology profile of broiler chickens. From this research, it was concluded that African leaf extract did not have a negative effect on the performance and profile of broiler chicken hematology.

1 Introduction

Antibiotics have been used as animal feed additives for several decades to increase livestock growth, feed efficiency, and productivity [1]. The continuous use of antibiotics in livestock feed can cause accumulated antibiotic residue in the livestock product, leading to livestock resistance to disease. Furthermore, antibiotic residue in the livestock product is also dangerous to consumers. The use of AGP additives as a growth promoter has been prohibited in Indonesia through the Ministry of Agriculture since January 1st, 2018.

* Corresponding author: samadi177@usk.ac.id

Therefore, it is necessary to find alternative replacements for antibiotics such as pre-probiotics, photogenic (herbs), organic acids, immunomodulators, and enzymes [2]. Several studies revealed that feed additives can increase feed quality, improve feed efficiency, and reduce mortality in livestock. Phytogenic (herbal) is an additive to replace antibiotics due to bio-active substances that possess pharmaceutical abilities that have anti-microbial, anti-fungal, and antioxidant effects. Several bioactive substances in plants can increase enzyme secretion in the digestive tract, improve feed consumption, and act as a stimulant to enhance immunity *(immunomodulator)* [3].

Research conducted by [4] on broilers fed with a mixture of feed and herbal feed , which contains essential oil, can improve feed conversion value, increase body weight, and lower the mortality rate. Furthermore, it can also increase the revenue of the chicken farm business. *V. amygdalina* is a plant with abundant potential, including prophylactic, therapeutic, and pharmacological effects. Additionally, *V. amygdalina* has a low toxicity profile, making it a potential alternative antibiotic. Related research regarding herbal feed additives is still limited and incomprehensive with several parameters. This current study aims to develop a safe and healthy feed additive with minimal adverse effects on consumers.

2 Material and Methods

2.1 Animal and Nutrition

To obtain the plant extract used in this study, dried *V. amygdalina* leaves were ground into powder and macerated in 95% ethanol (1:3, w/v) for 48 h at room temperature. The mixture was then filtered, and the filtrate was concentrated using a rotary evaporator at 40 °C at 60 rpm to obtain a viscous extract. The concentrated extract was subsequently dissolved in drinking water with the addition of 1% carboxymethyl cellulose (CMC) to ensure uniform dispersion. The study was performed at a private enterprise farm in Banda Aceh, and hematology profile analysis of broiler chickens with leukocyte, platelet, erythrocyte, hematocrit, and haemoglobin parameters was carried out in the laboratory Clinic Faculty Medical USK, Banda Aceh. This study was approved by the Committee on Veterinary Ethics for animal use in the Faculty of Veterinary Medicine of Syiah Kuala University, Banda Aceh, Indonesia with the reference No.268/KEPH/VII/2023.

This study used a Complete Randomized Design (CRD) with 4 treatments and 5 replications. A total of 100 DOC broiler chickens were randomly placed with 5 DOC per cage unit (total of 20 pen units). Treatment given is different doses of ethanol extract *V. amygdalina* mixed in drinking water (A0= control; A1= 250 mg/L; A2= 500 mg/L; and A3= 750 mg/L). Feed and drinking water were given *ad libitum* during research, and commercial feed was used during the study, containing 24% crude protein and 3200 kcal/kg. Feed intake and the individual weight of broiler chickens were recorded weekly intervals to measure for Feed Intake (FI), Feed Conversion Ratio (FCR), and Body Weight Gain (BWG). Mortality of broiler was recorded and weighted on to daily basis to adjust for the growth of performance.

At the end of the research, a total of 20 broiler chickens (1 per cage unit) were selected, and the blood was taken for hematological tests. The blood was taken through the jugular vein and inserted into the purple Vacutainer tube. Hematological parameters were leukocytes, platelets, erythrocytes, hematocrit, and hemoglobin. Hematology profile analysis uses an automatic hematology analyzer [Model: BC-2800, Shenzhen Mindray Electronics Biomedicine, Germany].

2.1 Data Collection

This study used a Complete Randomized Design (CRD) with 4 treatments and 5 replications. Observed parameters were livestock performance (weight, feed consumption and ration efficiency) and hematology profile (leukocytes, platelets, erythrocytes, hematocrit, and hemoglobin). All observation data is processed statistically using the SPSS program (version 12 for Windows). All data are presented in mean ± SD. Multi-treatments were compared by Duncan Duncan's Multiple Range Test (DMRT).

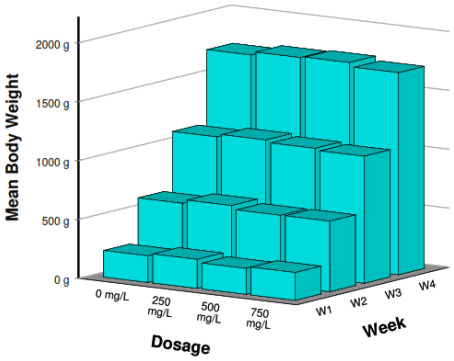
3 Results and Discussion

3.1 Broiler Chicken Performance

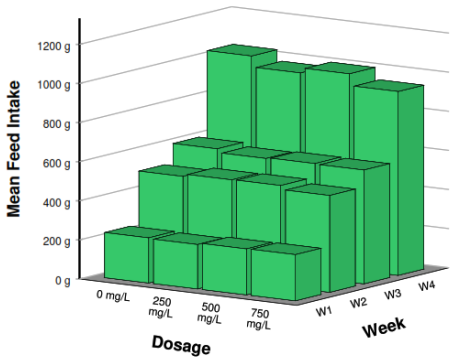
Administration of extracted *V. amygdalina* on the performance of broiler chickens is presented in Figure 1. Figure 1, including performance parameters (a) body weight, (b) feed consumption, and (c) feed conversion. Supplementation of *V. amygdalina* ethanol extract in drinking water at levels up to 750 mg/L did not significantly affect growth performance of broiler chickens (P>0.05). The weight gain of broiler chickens up to 4 weeks (g ± SEM) was 1655.15 ± 29.2, 1683.2 ± 55.12, 1669.2 ± 31.13, and 1630.8 ± 88.76 for A0, A1, A2, and A3. In Figure 1, it is evident that the increase in weekly body gain varies, which is influenced by the consumption of different feeds each week. Feed consumption and daily gain are linearly affected by each other [5]. Genetic factors also influence an increase in body weight. Samadi et al [6] reported that a 1-month-old super native chicken's body weight is 200 grams per head.

The feed consumption between treatments shows no significant difference (P>0.05) with giving different doses of *V. amygdalina* in drinking water. Similar to weight, the genetics of livestock are a factor that affects the feed consumption and also the feed conversion. In this study, weekly feed consumption (g±SEM) of each treatment average is 2374.38±138.54; 2297.2±49.56; 2336.72±34.74, and 2254.12±68.11 while FCR value 1.434 ± 0.08; 1.366 ± 0.02; 1.4 ± 0.03; and 1.386 ± 0.05 for A0, A1, A2, and A3.

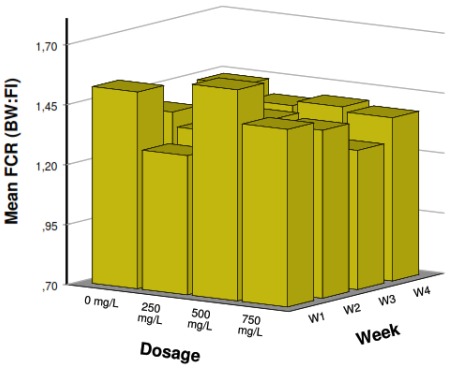
A study by Samadi et al. [9] with the addition of *Zingiber zerumbet* extracts up to 0.075% in drinking water also no significant difference in feed consumption (b) and feed conversion (c) at Figure 1.



(a)



(b)



(c)

Figure 1. The effect of ethanol extract from African leaf (*Vernonia amygdalina)* as a feed additive on body weight (a), feed consumption (b), and feed conversion (c) of broiler chickens measured weekly up to 4 weeks. (A0 = control; A1 = 250 mg ethanol extract of African leaves; A2 = 500 mg ethanol extract of African leaves; and A3 = 750 mg ethanol extract of African leaves).

Administration of extracted *V. amygdalina* with different doses shows no significant difference in weight, feed consumption, and FCR. Nevertheless, numerical trends suggested a dose-related response. Broilers receiving 500 mg/L tended to exhibit higher body weight, whereas birds given 750 mg/L showed reduced feed intake and body weight, indicating a possible decline in palatability at higher concentrations due to the presence of bitter secondary metabolites. The tendency toward improved feed conversion ratio at 250 mg/L further indicates that low-dose supplementation may enhance nutrient utilization efficiency, particularly under feeding conditions based on nutritionally balanced commercial diets.

Research conducted by Samadi et al. [7] giving *Z. zerumbet* rhizome extract up to 6% in drinking water also does not show any effect on body weight, feed conversion, and FCR of broiler chickens. In addition, ethanol extract from jamblang leaf in drinking water up to 1% shows no influence on weight, feed consumption, and FCR of broiler chickens [5]. A study by Berliana et al. [8] with the addition of turmeric flour in rations containing black garlic does not give a difference in weight, feed consumption, and FCR of broiler chickens.

Other research carried out by Rafiqi et al. [2]with the addition of *Z. zerumbet* extract showed no differences in weight, consumption ratio, and FCR of broiler chickens. Numerous studies conducted using photogenic feed additives as an alternative to replace antibiotics showed different results. The environmental factors, such as stress and comfort, can also influence the performance of livestock.

(b)

3.2 Hematology Profile

Hematology profile of broiler chickens given ethanol extract from *V. amygdalina* is summarized in Table 1. Measurement of hematology profile can be used as an indicator of health status for livestock, including physiological and pathological after animals are given *feed additives*. As shown in Table 1, there is no significant effect (P>0.05) on hematology profile of broiler chickens treated with ethanol extract from *V. amygdalina* in drinking water. The hematological parameters measured in this study were still within the physiological range. This study shows different results compared to previous research by Samadi et al. [6] where the application of different feed additives in animal feed has a significant effect (P<0.05) on the hematological profile, including erythrosin, platelets, and hemoglobin, but not on hematocrit and leukocytes.

The concentration of leukocytes in the blood indicates infection in the body. Research by Samadi et al. [9] with the addition of jamblang leaf extract to drinking water up to a dose of 1% was no significant difference in the blood hematological profile of broiler chickens Table 1.

Table 1. Hematology profile of broiler chickens given ethanol extract from *V. amygdalina* through drinking water with different concentrations.

Hematology Profile	**A0**	**A1**	**A2**	**A3**	**Mean±SEM**	**p-Value**
Leukocytes (10^3 µL)	22.76	27.05	24.49	25.13	24.86 ± 2.24	0.938
Erythrocytes (10^6 µL)	2.94	3.52	2.66	4.36	3.37 ± 0.51	0.681
Hemoglobin (g/dL)	6.74	8.08	7.06	6.80	7.17 ± 0.24	0.165
Hematocrit (%)	30.00	30.20	30.20	31.00	30.35 ± 0.66	0.961

Information: A0 = control; A1 = 250 mg ethanol extract of *V. amygdalina*; A2 = 500 mg ethanol extract of *V. amygdalina*; and A3 = 750 mg ethanol extract of *V. amygdalina*; SEM = *standard error of the mean*

Hematological indices were not significantly influenced by *V. amygdalina* ethanol extract supplementation and remained within normal physiological ranges, confirming the absence of adverse systemic effects. Numerically higher leukocyte and hemoglobin values observed at 250 mg/L may reflect mild immunomodulatory and antioxidant activity, consistent with the reported bioactive properties of *V. amygdalina*. Elevated erythrocyte and hematocrit values at 750 mg/L could be associated with physiological adaptation, possibly related to water intake dynamics, rather than pathological alteration. Overall, the findings indicate that *V. amygdalina* ethanol extract administered via drinking water is physiologically safe and shows biologically relevant trends at moderate inclusion levels, warranting further investigation under more challenging production conditions.

Research conducted by Toghyani et al. [10] who substituted thyme powder to replace antibiotics also did not show a significant effect (P>0.05) on the concentration of leukocytes in chicken blood plasma. However, in this study, we did not measure the leukocyte concentration after treatment in blood plasma. Another study conducted by Samadi et al. (6) showed that hematological parameters such as HCT, Hb, WBC and RBC increased significantly compared to the control group. Ansari et al. [11] reported that supplementation of 1.25-5.0 grams of dried *Azadirachta indica* leaf powder in kg of feed as a phytogenic feed additive had no detrimental effect on hematological parameters in chickens, meaning that *A. indica* could be used as a substitute for antibiotics in animal feed.

4 Conclusion

Supplementation of *V. amygdalina* extract in drinking water up to 750 mg/L did not significantly alter growth performance or hematological profiles of broiler chickens. However, numerical trends indicate dose-related biological responses, with lower to moderate inclusion levels (250–500 mg/L) showing potentially favorable tendencies without adverse physiological effects. This study provides evidence on the safety and biological response pattern of *V. amygdalina* extract administered via drinking water under commercial feeding conditions, offering a basis for further optimization of its use as a phytobiotic in antibiotic-free broiler production.

Acknowledgments

This study was supported by Universitas Syiah Kuala Grand under the Professorship scheme in 2023. The authors express gratitude to LPPM USK for administrative support. This study was approved by the Committee on Veterinary Ethics for animal use in the Faculty of Veterinary Medicine of Syiah Kuala University, Banda Aceh, Indonesia with the reference No.268/KEPH/VII/2023.

References

1. G. Gonzalez-Ortiz, D. Sola-Oriol, M. Martinez-Mora, J. F. Perez, and M. R. Bedford, Poult Sci **96**, 2776 (2017)
2. R. Rafiqi, M. A. Ryanda, M. A. Fuadi, N. Riwa, I. Wahyudi, I. Ilham, A. Allaily, S. Wajizah, and S. Samadi, Jurnal Kedokteran Hewan - Indonesian Journal of Veterinary Sciences **16**, (2022)
3. A. Sinurat, B. Wibowo, T. Purwadaria, and T. Haryati, *Evaluation on the Biological Effectivity of BS4 Enzymes in Laying Hens Diet at Commercial Farms Level* (2016)
4. K. W. Lee, H. Everts, and A. C. Beynen, Int J Poult Sci **3**, 738 (2004)
5. D. Setiadi, N. Khaira, and S. Tantalo, *The Comparison of Live Weight, Carcass, Giblet, and Abdominal Fat of Roosters Medium Type with Different Strain That Given Commercial Broiler Ration* (n.d.)
6. Samadi, M. Delima, and Herawati, IOP Conf Ser Earth Environ Sci **260**, 012065 (2019)
7. S. Samadi, S. Wajizah, and A. Tarman, IOP Conf Ser Earth Environ Sci **497**, 012048 (2020)
8. Berliana, Nelwida, and Nurhayati, Buletin Peternakan **45**, 95 (2021)
9. Samadi, S. Wajizah, A. Tarman, Ilham, and I. Wahyudi, IOP Conf Ser Earth Environ Sci **951**, 012079 (2022)
10. M. Toghyani, M. Tohidi, A. A. Gheisari, and S. A. Tabeidian, African Journal of Biotechnology **9**, 6819 (2010)
11. J. Ansari, S. H. Khan, A. Ul Haq, and M. Yousafb, J Appl Anim Res **40**, 336 (2012)