UTILIZATION OF SUPPLEMENTAL LEVELS OF BITTER LEAF (*VERNONIA AMYGDALINA*) MEAL BY BROILER CHICKENS

Supported by tetfund TERTIARY EDUCATION TRUST FUND

***[1]Tarimbuka, L. I and [2]Wafar, R. J.**
[1]Department of Animal Health and Production Technology, Adamawa State College of Agriculture, Ganye, Adamawa State, Nigeria
[2]Department of Animal Production and Health, Federal University, Wukari, Taraba State, Nigeria
Corresponding Email address:litarimbuka@gmail.com

Received: December 14, 2023 Accepted: March 28, 2024

Abstract: This study was conducted to evaluate the effect of feeding supplemental levels of *Vernonia Amygdalina* leaf meal (VLM) on broiler chickens. One hundred and fifty day-old Marshall broiler chickens were used. The birds were randomly assigned into five dietary treatments with 10 birds per replicate in completely randomized design. VLM was added at 0, 2.5, 5, 7.5 and 9g/kg to basal diets compounded for both starter and finisher phases. The level of supplementation (0, 2.5, 5, 7.5 and 9g/kg) was designated as A1 (control), A2, A3, A4 and A5, respectively. The result of the growth performance revealed an inverse relationship between feed intake, weight gain, and final weights with the inclusion of VLM. These parameters exhibited significant differences (P<0.05) across the various dietary treatments. Notably, similar values (P>0.05) were observed for the Feed Conversion Ratio (FCR) between broiler chickens fed control diet A1 (0g/kgVLM), A2 (2.5g/kgVLM) and A3 (5g/kgVLM). Conversely, birds fed A4 (7.5g/kgVLM) and A5 (9g/kgVLM displayed the poorest FCR. The hemoglobin concentration (Hb) and Red Blood Cell (RBC) levels were similar across the dietary treatments (P > 0.05), although they numerically increased as levels of VLM increased in the diets. However, the Packed Cell Volume (PCV) and total White Blood Cell (WBC) count significantly increased. Serum cholesterol, glucose levels of birds fed VLM significantly (P<0.05) reduced with increasing levels of VLM supplementation.it was concluded from the study that supplementing broiler chickens with VLM up-to 5g/kg had no adverse effect on the performance, as well as reduced the total cholesterol, LDL and glucose levels of broiler chickens.5g/kg is therefore recommended for broiler chickens.

Keywords: Broiler Chickens, Growth, Performance, Sun dried, *Vernonia amygdalina*

Introduction

The critical role of animal protein in both human and animal nutrition cannot be overstated (Akorede et *al.,* 2021). However, there is a significant disparity between the production and supply of animal protein to meet the needs of the growing population (Lamorde, 1997). Nigeria, in particular, faces a substantial deficit in animal protein security, with per capita consumption far below the recommended levels set by the food and Agriculture (FAO) for proper growth and development (Esobhawan *et al.,* 2008). This deficit poses a significant challenge to Nigeria, requiring substantial efforts to increase domestic animal supply and address the shortage of animal protein in the populace's diet (Bamaiyi, 2013). A primary obstacle to the development and expansion of livestock industries in developing countries like Nigeria is the limited supply, high demand, and costly nature of conventional protein sources in livestock feeds (Owen *et al.,* 2009). The escalating costs of livestock feeds, coupled with the subsequent rise in the prices of animal products such as meat, eggs, and milk, underscore the urgent need to explore alternative feed ingredients for domesticated animals. In this context, bitter leaf (*Vernonia amygdalina*) emerges as a promising non-conventional feed ingredient due to its nutritional value and widespread cultivation in Nigeria. Various studies have reported different crude protein values for VLM indicating its potential as a viable feed source. Durunna *et al*. (2009) reported 15.67% while Bonsi *et al.* (1995) and Okoli *et al*. (2003) reported Crude protein (CP) range of 18 - 32.60%. Given its nutritional profile, VLM presents an opportunity to address the protein gap, particularly in poultry production, which plays a crucial role in supplying both eggs and meat. While previous research has examined the performance of laying hens fed graded levels of sun-dried VLM, this study aims to investigate the response of Noiler chickens fed supplemental levels of VLM. The objective of this study is to evaluate the impact of VLM supplementation on broiler chicken growth performance and blood profile.

Materials and methods

The study was conducted at the Poultry Unit of Department of Animal Production and Health, Teaching and Research Farm, Federal University Wukari, Taraba State.

Fresh *Vernonia amygdalina* leaves were sourced in within Wukari and environs. The leaves were subjected to sun-drying, followed by crushing, milled and tagged as *Vernonia amygdalina* leaf meal (VLM).

A total of 150 day old Marshal Strain broiler chicks sourced from Obasanjo Farm, Ota, Ogun state, Nigeria. The birds were randomly assigned to five dietary treatments labeled A1 (0g/kg/VLM) control diet, A2 (2.5g/kg/VLM), A3 (5g/kg/VLM), A4 (7.5g/kg/VLM) and A5 (9g/kg/VLM). Each treatment was replicated three times, with 10 birds per replicate in Completely Randomized Design (CRD). Water and feed were provided *ad libitum* throughout the period of the experiment.

Data on the growth performance of broiler chicks were obtained through records of daily feed intake and weekly body weight. These records were used to calculate the feed conversion ratio (feed consumed divided by weight gain) at the end of the experiment.

Blood parameters were also assessed at the end of the feeding trial. Three birds were randomly selected from each replicate group, and 2 mL of blood was collected from the wing vein using a sterile needle into labeled sterilized bottles containing EDTA as an anticoagulant. These samples were used to determine Packed Cell Volume (PCV), Red Blood Cell (RBC), White Blood Cell (WBC), and hemoglobin (Hb) count following Dein (1984). Another 2 mL of blood was collected without anticoagulant into a vacutainer to determine serum biochemical indices, including total protein, albumin, glucose, globulin, cholesterol, low density lipoteins (LDL), and High density lipoteins (HDL) levels in the blood.

The collected data were subjected to one-way Analysis Of Variance (ANOVA) using JMP SAS version 13 (2013), where significant differences were observed, means were separated using Duncan's New Multiple Range Test. The experimental model applied was:

$X_{ij} = \mu + T_i + E_{ij}$ Where:

X_{ij} = Any observation made in the experiment

μ= Observed mean

T_i = Effect of supplemental levels (i = 0, 2.5,5, 7.5 and 9g/kg)

E_{ij} = Residual error

Table 1 ingredient and percentage composition of experimental diets

Ingredients	Starter	Finisher
Maize	52.00	58.00
Maize Offal	9.00	10.00
Soybean	21.00	16.00
kapok cake	8.00	7.00
Dicalcium Phosphate	2.00	2.00
Fish meal	5.00	4.00
Bone meal	1.00	1.00
limestone	1.00	1.00
Vitamin/Mineral Premix*	0.25	0.25
Lysine	0.25	0.25
Methionine	0.25	0.25
Salt	0.25	0.25
Total	**100**	**100**
Crude protein	22.50	18.76
Fat/oil	5.00	4.00
Crude fibre	4.00	5.00
Calcium	1.50	1.74
Available phosphorus	0.75	0.4.3
Lysine	1.25	0.86
Methionine	0.57	0.56
ME (kcal kg)	2900	3010

*premix composition (per kg of diet): vitamin A, 12500 IU; vitamin D3, 2500 IU; vitamin E, 50.00 mg; vitamin K3, 2.50 mg; vitamin B1, 3.00 mg; vitamin B2, 6.00 mg; vitamin B6, 6.00 mg; niacin, 40 mg; calcium pantothenic, 10 mg; biotin, 0.08 mg; vitamin B12, 0.25 mg; folic acid, 1.00 mg; chlorine chloride, 300 mg; manganese, 100 mg; iron, 50 mg; zinc, 45 mg; copper, 2.00 mg; iodine, 1.55 mg; cobalt, 0.25 mg; selenium, 0.10 mg; and antioxidant, 200 mg

Results and Discussions

Growth performance of broilers chickens fed supplemental levels of VLM

Table 2 showed the growth performance of broilers chickens supplemental levels of VLM. The initial body weight of the experimental animals ranged from 47.42g to 48.53g.Total Feed Intake TFI) was significantly ($P<0.05$) influenced by supplemental levels of VLM. TFI of the experimental birds declined with an increase in the level VLM supplementation. Birds fed A1 (0g/kgVLM) 5242.12g, A2 (2.5g/kgVLM) 5124.0g and A3 (5g/kgVLM) 5131.40gdiets recorded significantly ($P<0.05$) higher TFI This study observed decrease in feed intake with increasing levels of VLM supplementation in the experiment. This finding contrasts with a report by Owen *et al. (*2010), who administered bitter leaf extract infusion in broiler drinking water. However, the trend in feed intake aligns with the findings of Durunna *et al*. (2011) for finisher broilers, where a decrease in feed intake occurred with increasing levels of bitter leaf meal inclusion. This decrease in feed intake could be attributed to rising concentrations of antinutritional factors such as alkaloids and saponins (Esonu *et al.*, 2006), which might inhibit the utilization of essential nutrients and depress bird feed intake, studies have shown that alkaloids and saponins impaired nutrient utilization in broiler chicken (Yakubu *et al.*, 2027 and Wafar *et al.*, 2018).

The total body weight gain (TBWG) and final body weight (FBW) varied across the different dietary treatments. The A1 (0g/kgVLM) diet recorded the highest TBWG at 2372.77g, whereas birds fed 9g/kgVLM (A5) diet exhibited the lowest TBWG of 1301.12g. There was a significant decrease ($P < 0.05$) in TBWG with increasing levels of VLM inclusion. TBWG and FBW diminished with increasing levels of bitter leaf meal inclusion. This outcome corresponds to the findings of Damron and Jacob (2002) in a similar experiment with chicks and hens, where 5g inclusion level of *Cassia obtusifolia* depressed feed intake and consequently affected growth. The similar trend observed in birds on birds fed 0g/kgVLM (A1) , 2.5g/kgVLM (A2) and 5g/kgVLM (A3) diets might be attributed to the active components (alkaloids, saponins, tannins, and glycosides) of VLM, which could establish a harmonious gut environment conducive to the release and assimilation of digestive nutrients necessary for growth up to. However, at higher VLM levels, the harmonious gut environment may have been disrupted by nutrient imbalance and improper metabolism, consistent with the views of D'mello, (1986) regarding *Leucaena leucocephala* leaf meal inclusion in chicken diets above 5%, where growth retardation occurred.

Feed Conversion Ratio (FCR) showed Significant differences ($P < 0.05$) across the various dietary treatments. FCR was comparable ($P < 0.05$) for broilers on the control diet (0g/kgVLM), 2.5g/kgVLM (A2) and 5g/kgVLM (A3) with values of 2.16, 2.46 and 2.21, respectively. A lower Feed Conversion Ratio (FCR) in this study corresponded to higher mean weight gained, indicating more efficient conversion of feed consumed to meat. This finding is consistent with the results of Olobatoke and Oloniruha (2009), who reported that inclusion of bitter leaf powder in cockerel feed significantly improved FCR.

Table 2 Growth performance of broilers chickens fed supplemental levels of VLM

Parameter	A1 (0g/kgVLM)	A2 (2.5g/kgVLM)	A3 (5g/kgVLM)	A4 (7.5g/kgVLM)	A5 (9g/kgVLM)	SEM
initial body weight (g)	48.25	48.19	47.42	48.53	48.18	0.48
Final Body weight (g)	2421.02^{a}	2082.14^{b}	2313.14^{a}	1480.25^{c}	1301.12^{d}	19.19
Total body weight gain (g)	2372.77^{a}	2033.95^{b}	2265.72^{a}	1431.72^{c}	1253.02^{d}	18.71
Total feed intake (g)	5242.12^{a}	5124.02^{a}	5131.4^{a}	4491.25^{c}	4031.45d	48.04
Feed conversion ratio	2.16^{b}	2.46^{b}	2.21^{b}	3.03^{a}	3.09^{a}	0.02

Mean on same bearing different superscript differ significantly ($P<0.05$)
SEM = Standard error mean

Effect of VLM on Blood profile of Broiler chickens

Table 3 presents the blood parameters of the experimental birds. The hemoglobin concentration (Hb) and Red Blood Cell (RBC) levels in the experimental birds did not show statistical differences ($P > 0.05$), although they numerically increased as levels of VLM increased in the diets. Osho *et al.* (2014) demonstrated that oral administration *Vernonia amygdalina* leaf extracts to broiler chickens did not significantly affect the Hb and RBC level among dietary treatments. However, the Packed Cell Volume (PCV) and total White Blood Cell (WBC) count of the birds were significantly increased A4 (7.5g/kgVLM). This observation aligns with the findings of Owen and Amakiri (2011), who noted that increasing levels of *Vernonia amygdalina* leaf meal influenced all hematological indices measured, except for WBC. Aregheore *et al. (*1998) suggested that the presence of certain phytochemicals in *Vernonia amygdalina* leaf may induce the animal to respond as if it has an infection, thereby increasing WBC count. The PCV values observed were within the normal range of 25-45% reported by Vivian *et al.* (2015)

Results in Table 3 also revealed that supplemental of VLM significantly ($p < 0.05$) reduced serum cholesterol in the blood plasma. The LDL levels of birds fed supplemental levels of VLM on were similar, but significantly Lower than ($p < 0.05$) those on A1 (0g/kgVLM). This finding is consistent with previous studies by Nwanjo and Nwokoro (2004), Ojiako and Nwanjo (2006), and Owen et al. (2011), which demonstrated the cholesterol-lowering potential of bitter leaf. Increased activity of the enzyme catalase involved in esterification of cholesterol in the plasma could have influenced the decrease in serum cholesterol in the birds fed VLM supplemented diets. Birds on VLM supplemented diets had better HDL values compared to those on A1 (0g/kgVLM), indicating that supplementation of VLM could prevent high serum lipid levels.

The glucose levels of birds fed VLM was significantly reduced with increasing levels of VLM supplementation. A reduction in glucose levels observed in this study confirmed previous findings suggesting that *Vernonia amygdalina* has a hypoglycemic effect. This effect may be attributed to the targeting of insulin synthesis/production from the beta-cells of the islet of Langerhans and the peripheral carbohydrate mechanism (Vivian *et al.*, 2015)

Total protein and albumin tests serve as crucial indicators in assessing the health status of animals, often aiding in disease diagnosis and monitoring changes in their well-being. Total protein, comprising albumin and globulin content in the blood, reflects the nutritional status of birds. Decreased albumin levels may indicate liver or kidney-related diseases or the presence of infections. In this study, the total protein levels of birds in treatment A1 (0g/kg VLM), A2 (2.5g/kgVLM) and A3 (5g/kgVLM) were significantly higher than those in other treatments, indicating better overall nutritional status. A similar trend was observed in albumin levels. This finding aligns with a previous report by Owen *et al.* (2011), reinforcing the notion that higher total protein and albumin levels correlate with improved health and nutritional status in birds.

Table3 Effect of VLM on Blood profile of Broiler chickens

Parameter	A1 (0g/kgVLM)	A2 (2.5g/kgVLM)	A3 (5g/kgVLM)	A4 (7.5g/kgVLM)	A5 (9g/kgVLM)	SEM
PCV (%)	25.78^{b}	32.43^{a}	30.96^{a}	31.53^{a}	32.45^{a}	1.53
Hb (g /dL)	10.14	10.64	10.11	10.23	10.55	0.51
WBC ($^{x}10^{3}/mm^{3}$)	443.32^{b}	447.23^{b}	453.65^{b}	512.43^{a}	523.45^{a}	23.80
RBC ($x10^{6}/mm^{3}$)	4.09	4.29	4.25	4.19	4.21	0.21
MCH (pg)	25.96	24.73	23.67	24.23	23.71	1.22
MCV (fl)	68.98	74.75	71.88	75.24	74.67	3.65
MCHC (%)	34.73	31.85	39.13	34.82	35.67	1.76
Total protein (g/dl)	40.59	43.67	44.86	43.89	45.86	2.18
Albumin (g /dL)	20.89	21.88	23.87	22.92	21.76	1.11
LDL (mg /dL)	147.96^{a}	112.67^{b}	111.91^{b}	111.08^{b}	110.56^{b}	5.94
HDL (mg /dL)	43.21	59.68	58.16	57.19	57.98	2.76
Glucose (mg/dL)	146.86^{a}	134.78^{b}	130.82^{b}	127.82^{c}	126.09^{c}	6.56

Mean on same bearing different superscript differ significantly ($P<0.05$)
SEM = Standard error mean

Conclusion

Supplementing broiler chickens with VLM up-to 5g/kg had no adverse effect on the performance, as well as reduced the total cholesterol, LDL and glucose level of broiler chickens.5g/kg is therefore recommended for broiler chickens diet

References

Akorede AA, Bolu SA, Sola-Ojo FE and Yusuf OA 2021. Effects of graded levels of *Vernonia amygdalina* (Bitter) leaf meal based diets on performance of broilers chickens, Nigerian Journal of Animal Science, 23 (2): 222-231

Aregheore EMK, Makkar HPS and Becker K 1998. Feed value of some browse plants from the central zone of Delta State, Nigeria. Trop. Sci., 38: 97-104.

Bamaiyi PH. 2013. Factors Militating Against Animal Production in Nigeria. International Journal of Livestock Research, Vol 3(2) May'13

Bonsi MLK, Osuji PO, Tuah AK, and Umunna MN 1995. *Vernonia amygdalina* as supplement of teff straw (Eragrostis tef) fed to Ethiopian Menz sheep. Agroforestry System, 31: 229- 244.

Durunna CS, Chiaka II, Udedibie, ABI, Ezeokeke, CT & Obikonu HO. 2009. Value of bitter leaf (*Vernonia amygdalina)* leaf meal as feed ingredients in diet of finisher broiler chicken. Proceedings International Conference on Global Food Crisis. FUT Owerri, Nigeria, April 19-24th. pp 38 - 42.

Durunna ON, Mujibi, FDN, Goonewardene L, Okine, EK., Basarab, JA., Wang, Z and Moore, SS. 2011. Feed efficiency differences and reranking in beef steers fed grower and finisher diets. Journal of Animal Science, 89:158-167

Esonu BO, Opara, MN, Okoli I C, Obikaonu HO, Udedibe, C & Iheshiulor, OOM (2006). Physiological response of laying birds to neem (*Azadirachta indica*) leaf meal-based diets: body weight, organ characteristics and haematology. Journal of Health and Allied Sciences, 2:4.

Damron BL. and Jacob, JP. 2002. Toxicity to poultry of common weed seeds. Florida cooperation Extension services, Institute of Food and Agricultural Sciences University of Florida.

D'Mello JPE, and Acamovic T. 1989. *Leucaena leucocephala* in poultry nutrition. Animal Feed Science and Technology. 26: 1-28.

Esobhawan AO, Ojo SO, & Ikhelao, EE 2008. Profitability, input elasticity and returns to scale in agriculture production in Lagos State. Proceeding of 14th Annual Conference of Agriculture in Nigeria. Wetlands FUTA, Akure 21st May. Pp 219 – 222.

Lamorde AG 1997. Research priorities for sustainable women empowerment and development. A paper presented at the National Conference on Research as Backbone for Sustainable Development held in Abuja, 11th – 15th August

Nwanjo HU & Nwokoro,EA 2004. Antidiabetic and biochemical effects of aqueous extract of *Vernonia amygdalina* leaf in normoglycaemic and diabetic rats. J. Innov. Life Sci., 7: 6-10.

Ojiako OA. & Nwanjo HU 2006. Is *Vernonia amygdalina* hepatotoxic or hepatoprotective? Response from biochemical and toxicity studies in rats. Afr. J. Biotechnol., 5: 1648-1651.

Okoli IC., Ebere CS., Uchegbu MC., Udah, CA & Ibeawuchi, II. 2003. Survey of the diversity of plants utilized for small ruminant feeding in South Eastern Nigeria. Agricultural Ecology and Environment, 45 (6), 25 - 29.

Olobatoke RY. & Oloniruha, JA. 2009. Haematological assessment of bitter leaf (*Vernonia amygdalina*) efficiency in reducing infections in cockerels. Proceedings of the World Congress on Medicinal and Aromatic Plants, November 9-14, 2008, Cape Town, South Africa, pp: 472-473

Osho IB, Akindahunsi A, Igbasan FA & Adekunle DJ 2014. Effect of orally administered bitter leaf (*Vernonia amygdalina*) extract on the growth performance and haematological parameters of broiler chicken. J. Vet. Med. Anim. Health, 6: 251-256.

Owen OJ, Alawa JP, Wekhe, SN, Isirimah, NO, Chukuigwe, EC, Aniebo, AO, Ngodigha, EM & Amakiri AO. 2009. Incorporating poultry litter in rabbit feed. A solid waste management strategy. Egyptian Journal of Animal Production, 46 (1): 63-68

Owen OJ, Amakiri, AO & Ezeano, CI. 2010. The cost benefits analysis of incorporating bitter leaf (*Vernonia amygdalina)* meal in broiler finishers' diet. Journal of Environmental Issues and Agriculture in Developing Countries, Vol. 2 No. 1,. Pp 131-141

Owen AJ & Amakiri, AO 2011. Serological and haematological profile of broiler finishers fed graded levels of bitter leaf (*Vernonia amygdalina*) meal. Adv. Agric. Biotechnol., 1: 77-81.

Owen OJ, O.A. Amakiri AO & Karibi-Botoye,TA 2011. Sugar-lowering effects of bitter leaf (*Vernonia amygdalina*) in experimental broiler finisher chickens. Asian J. Pharmacol. Clin. Res., 4: 19-21.

Vivian UO, Solomon O. Olorunleke, O and Iyakutuye J 2015 Comparative Response of Bitter Leaf (*Vernonia amygdalina*) Infusion Administration on Performance, Haematology and Serum Biochemistry of Broiler Chicks 1, Asian Journal of Animal Sciences 9 (5): 217-224, 2015

Yakubu B; Mbahi, TF, Haniel, G and Wafar, RJ 2017. Effects of Feeding *Cassia obtusifolia* Leaf Meal on Growth Performance, Carcass Characteristics and Blood profile of Broiler Chickens. *Greener Journal of Agricultural Sciences. Vol. 7(1) Pp001- 008*

Wafar RJ, Yakubu B; Yusuf HB and Antyev M 2018. Effect of Feeding Raw and Differently Processed Kapok (*Ceiba pentandra*) Seed Meal on the Growth Performance and Carcass Characteristics of Weaner Rabbits. *Nigerian Journal of Animal Science 20(2): 258 – 270.*