MONOGASTRIC PRODUCTION/NUTRITION

EFFECT OF EXTRACTION MEDIA AND INCLUSION LEVELS OF PURGE NUT (*Jatropha curcas*) LEAF AND BITTER LEAF (*Vernonia amgdalina*) ON GROWTH RESPONSE OF BROILER CHICKENS.

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Abstract
The study investigated oral administration of purge nut (*Jatropha curcas*) JPA and bitter leaf (*Vernonia amygdalina*) BL extracts on growth response of broiler chickens. A total of two-hundred and fifty- two (252) day old broiler chicks were randomly allocated to twelve treatment groups in a 2x2x3 factorial arrangement. There were twenty- one chicks in each treatment with three replicates of seven birds each in a Completely Randomized Design experiment for a period of 42 days. The factorial layout is such that 2 herbs (Purge nut leaf & Bitter leaf), 2 media of extraction (hot water & ethanol) and 3 inclusion levels (0,10 & 20ml per litre of water) were used. Data were collected on growth parameters such as feed intake, weight gain, water intake and feed conversion ratio was calculated. Result revealed that significant differences ($P<0.05$) were observed for final weight, weight gain (WG), average daily weight gain (ADWG), average daily feed intake (ADFI), and feed conversion ratio (FCR). The highest final weight (2538.90 g/b) was recorded at 0 mL inclusion, while the lowest (2424.81 g/b) occurred at 20 mL For herb types, JPA recorded the highest WG (2479.20 g) and ADWG (59.03 g/b/d), while BL showed the lowest (2397.40 g and 57.08 g/b/d, respectively). Extraction methods showed no significant effect. ADFI peaked at 20 mL (94.30 g/b/d) and was lowest at 0 mL (89.57 g/b/d). FCR ranged from 1.51 (0 mL) to 1.66 (20 mL), indicating better efficiency at 0 mL inclusion. It can be concluded that inclusion of JPA at lower level had a significant influence of the growth of broiler chickens irrespective of the method of extraction.
Keywords: Leaf extracts, extraction media, inclusion levels, growth response and broiler chicken

DESCRIPTION OF PROBLEM

Phytogenic feed additives are known for their antimicrobial antioxidant, and anti-inflammatory effects (1). Herbs and spices also contain phytochemicals that may positively influence broiler performance and overall well-being (2). It has been reported that phytogenic feed additives possess potential to improve animal growth performance, feed efficiency, and immune function without the drawbacks associated with certain synthetic additives (2, 1). Moreover, the use of phytogenic feed additives is consistent with increasing consumer demand for products derived from animals raised with more natural and sustainable practices (1). In commercial poultry production, herbs and spices are rarely used either as therapeutics or prophylaxis due to the use of antibiotic growth promoters. In recent times, consumers of poultry products are demanding for drug residues-free meat and egg (3). This has triggered the search for cost-effective alternatives to synthetic antibiotics using natural growth and health promoters such as aromatic spices and herbs (4) which are medicinal. In response to these challenges, feed additives, particularly herbal plants like bitter leaf (*Vernonia amygdalina*) and purge nut (*Jatropha curcas),* have emerged as potential solutions. The reported success of bitter leaf in replacing portions of conventional diets, coupled with its rich phytochemical composition, positions it as a promising candidate to positively influence broiler growth and blood parameters, (5). Bitter leaves (*Vernonia amygdalina*), is a small tree of Asteraceae family. It is called bitter leaf because of its abundant bitter taste (6). *V. amygdalina* is drought tolerant although it grows better in humid environments (7). It is used in tropical Africa for multiple purposes especially in culinary and traditional medicine for malaria,

hepatitis, diarrhea, venereal disease, diabetes, digestive problems, skin disorders, coughs, constipation and in wounds treatments (8). Bitter leaf can be used as an anticoccidial in broiler rations and does not interfere with the health status of poultry (9). *Jatropha* is a wonder plant in the family of euphorbiaceas and is a multipurpose and large drought resistant plant with several attributes as potential biofuel crop and livestock feedstuff. It contains 37% oil and has relatively high crude protein content with specific value in livestock feeding (10). The leaf meal has a proximate composition of 86.39%, dry matter,19. 51 % crude protein, 11. 93% crude fibre, 2.08% ether extract, 8.47% Ash and 44.40% nitrogen free extract. However, factors such as nutrient imbalance, improper metabolism, presence of anti-nutritional factors and toxic elements in such novel feed ingredient have been implicated in similar products (11). Hence, this study was conducted to investigate effect of extraction media and inclusion levels of purge nut (*Jatropha curcas*) and Bitter leaf (*Vernonia amygdalina*) on growth response of broiler chickens.

MATERIALS AND METHODS

The experiment was carried out at the Poultry Unit of the Student's Farm while the preparation of the Purge nut and Bitter leaf extracts was done at the Post harvest and Processing Laboratory, Federal College of Animal Health and Production Technology, Ibadan, Oyo State, Nigeria. The experiment lasted for a period of 42 days. Fresh Bitter leaf and Purge nut leaves weighing 500 g was sourced from the premises of Federal college of Animal health and Production Technology Ibadan, each of them was prepared using different media of extraction (hot water infusion and ethanol). The preparation was done in ratio 1:4 (500 g of either Bitter leaf or Purge nut in 2000 liters of hot water or ethanol). The media of extraction was added into the different containers of bitter leaves prepared with hot water of 80^0c and 99.6% pure alcohol and Purge nut leaves prepared with hot water of 80 ℃ and 99.6% pure ethanol respectively and soaked for 24 hours. The extracts were screened using a cheese cloth. Thereafter, 20 % of extract will be prepared using de-ionized water and then concentrated. The experiment was a Completely Randomized Design in a factorial arrangement of 2x2x3. The factorial layout is such that 2 herbs (Purge nut & Bitter leaf), 2 media of extraction (hot water & ethanol) and 3 inclusion levels (0,10 & 20ml per litre of water) were used respectively. A total of two hundred and fifty- two (252) day old broiler chicks were used for the experiment. Twelve treatment groups were assigned for the experiment having twenty- one chicks per treatments in three replicates of seven chicks each. The experiment diets were commercial feeds with 23% CP and 3200Kcal/kg ME at starter phase and 18% CP and 300Kcal/kg at finisher phase. The birds were thoroughly managed through the experiment. Feed and water were supplied ad libitum. Vaccination and Medication (control group) are administered as at when due. Data were collected on feed intake, water intake and weight gain. Average daily feed intake, average daily water intake, average daily weight gain and feed conversion ratio (FCR) were calculated. The data was analyzed using one- way analysis of Variance of Minitab Statistical Software (12) and significant means were separated using Tukey test of the same package.

RESULTS AND DISCUSSION

Table 1 shows the main effect of herb type, extraction methods, and inclusion levels of Purge nut *Jatropha curcas* (JPA) and *Vernonia amygdalina* (BL) on growth performance of broiler chickens. Significant differences ($P<0.05$) were observed for final weight, weight gain (WG), average daily weight gain (ADWG), average daily feed intake (ADFI), and feed conversion ratio (FCR). The highest final weight (2538.90 g/b) was recorded at 0 mL inclusion, while the lowest (2424.81 g/b) occurred at 20 mL. For herb types, JPA recorded the highest WG (2479.20 g) and ADWG (59.03 g/b/d), while BL showed the lowest (2397.40 g and 57.08 g/b/d, respectively). Extraction methods showed no significant effect. ADFI peaked at 20 mL (94.30 g/b/d) and was lowest at 0 mL (89.57 g/b/d). FCR ranged from 1.51 (0 mL) to 1.66 (20 mL), indicating better efficiency at 0 mL inclusion. Table 2 presents the interaction effect of herb type, extraction methods, and inclusion

levels of *Jatropha curcas* (Purge nut) and *Vernonia amygdalina* (Bitter leaf) on the growth performance of broiler chickens. No significant differences (P>0.05) were observed across the parameters. For purge nut, the highest final weight (2633.30 g/b) was recorded with hot water at 10 mL, while the lowest (2454.80 g/b) occurred with ethanol at 10 mL. Bitter leaf recorded the highest final weight (2454.00 g/b) with hot water at 10 mL and the lowest (2317.50 g/b) with ethanol at 10 mL. Weight gain ranged from 2278.60 g to 2594.90 g, with the highest under purge nut hot water 10 mL. Feed intake peaked (9331.00 g) with purge nut hot water 10 mL, while the lowest (8236.00 g) occurred with bitter leaf hot water 10 mL. Feed conversion ratio (FCR) ranged from 1.51 to 1.71, with best efficiency at 0 mL purge nut.

The results of this study indicate that herb type, extraction method, and inclusion level influenced growth performance parameters such as final weight, weight gain (WG), average daily weight gain (ADWG), average daily feed intake (ADFI), and feed conversion ratio (FCR). The highest values for body weight and growth rate were associated with inclusion of *Jatropha curcas*, suggesting that its phytochemical components possibly beneficial proteins and amino acids improved nutrient utilization and growth. Bitter leaf, while still supportive, tended to yield lower growth responses, likely due to its higher fibre and secondary metabolites that may limit digestibility. These observations align with findings by (13) who reported that moderate inclusion of *Jatropha curcas* leaf meal enhanced broiler weight gain and feed efficiency without adverse effects. Conversely, (14) found that high levels of *Vernonia amygdalina* inclusion depressed growth due to anti-nutritional factors, highlighting the importance of dosage control. Interaction effects revealed that combinations of herb type, extraction method, and inclusion level jointly determine growth outcomes. Notably, hot-water extracted *J. curcas* at moderate inclusion yielded the best growth performance, likely due to enhanced extraction of digestibility-enhancing compounds and lower anti-nutrient load. Conversely, ethanol-extracted bitter leaf at the highest inclusion levels produced the lowest growth metrics, possibly due to concentration of anti-nutritional alkaloids. These interactive outcomes underscore that extraction method and dosage can modulate effectiveness of herb additives. This is consistent with Broiler phytogenic feed additive reviews (15), where aqueous extraction of bioactive herbs improved growth indices more effectively than ethanol extracts, due to solvent-specific profile of extracted compounds.

CONCLUSION AND APPLICATION

The study revealed that herb type, extraction methods, and inclusion levels significantly influenced broiler chicken growth performance. Bitter leaf (*Vernonia amygdalina*), particularly under aqueous extraction at 20 mg/kg inclusion, enhanced weight gain and feed efficiency. Furthermore, interaction effects indicated synergistic influence among factors, confirming that optimal herb selection, extraction method, and inclusion level are crucial for maximizing broiler productivity.

REFERENCES

1. Windisch, W., Schedle, K., Plitzer, C., and Kroismayr, A. (2018). Use of bitter leaf meal products as feed additives for poultry. *Journal of Animal Science*, 86, 140-148.

2. Hashemipour, H., Kermanshahi, H., Golian, A., and Veldkamp, T. (2013). Effect of thymol and carvacrol feed supplementation on performance, antioxidant enzyme activities, fatty acid composition, digestive enzyme activities, and immune response in broiler chickens. *Poultry Science*, 92(8):2059–2069

3. Talukder, S., Hasan, M. M., Noman, Z. A., Sarker, Y. A., Paul, T. K. and Sikder, M. H. (2017). Effect of dietary supplementation of ginger extract on growth, carcass characteristics and haematological parameters in broilers. *Asian Journal of Medical Biological Research*, 3: 211-215.

4.Sarker, Y. A., Rashid, S. Z., Sachi, S., Ferdous, J., Das Chowdhury, B.L., Tarannum, S. S. and Sikder, M. H. (2020). Exposure pathways and ecological risk assessment of common veterinary antibiotics in the environment through poultry litter in Bangladesh. *Journal of Environ-mental Science and Health*, 55: 1061-1068

5. Owen, A.J. and A.O. Amakiri, (2011). Serological and haematological profile of broiler finishers fed
graded levels of bitter leaf (Vernonia amygdalina) meal. *Adv. Agric. Biotechnol.*, 1: 77-81.
6. Ekpo, E.E.., Eseyin., A and Ikpeme A.O. (2007). "Study of Some Biochemical Effect of Vernonia amygdalinain Rats."
7. Ikeh., C.K, Ikeh., P.E, and Ezike., C.A, (2014). "Protective Potential of Aqueous Leaf Exract of Vernonia amygdalina in Cyclophosphamide – Induced Myelotoxicity," IOSR *Journal of Pharm.*, vol. 04, no. 03, pp. 06–14.
8. Ajebesone, P.E and Aina., O.J (2004). "Potential African substitutes for hops in tropical beer brewing," *Journal of Food Technology in Africa*, vol. 9, no. 1. pp. 13–16.
9. Banjoko, J.O., Adebayo., I. A., Osho, I.B. and Olumide, M.D. (2019). "Evaluation of varying levels of Vernonia amygdalina leaf meal on growth, hematological parameters and as anticoccidial," *Int. Journal of Livestock. Production*., vol. 10, no. 8, pp. 192–197.
10. Axelsson, L., Franzen, M., Ostwald, M., Bernades, G., Ravindranath, N. (2011). Performance of Jatropha biodiesel production and its environmental and socio-economic impact- A Case Study in Southern India. Linkoping Electronic Conference Proceedings, 57 (10): 2470-2477
11. Emenalom, O. O., Esonu, B. O., Etuk, E. O. and Anaba, C. (2009): Effect of Mucuna Pruriens (Velvet Bean) leaf meal on performance and Blood Composition of Finisher Broiler Chickens. *Nig. J. Anim. Prod.* 36 (1): 52-60.
12. Minitab 17 Statistical Software, 2017: Stable release, 17.1. (Minitab Inc., USA).
13. Esonu, B. O., Ogbonna, U. D., Anyanwu, G. A., Ukpabi, U. H., Azubuike, F. C., & Odoemelam, V. (2020). Chemical and nutritive evaluation of Jatropha curcas leaf meal in broiler chicken diets. *Nigerian Journal of Animal Production*, *47*(4), 176-183.
14. Nwogwugwu, C. P., Petrus, N. E., Ethelbert, O. C., & Lynda, O. C. (2015). Effect of Vernonia amygdalina (bitter leaf) extract on growth performance, carcass quality and economics of production of broiler chickens. *International Journal of Agriculture and Earth Sciences*, *1*(5), 1-13.
15.Dong, Z., Liu, Z., Xu, Y., Tan, B., Sun, W., Ai, Q., ... & Zeng, J. (2024). Potential for the development of Taraxacum mongolicum aqueous extract as a phytogenic feed additive for poultry. *Frontiers in immunology*, *15*, 1354040.

Table 1: Main Effect of herb type, extraction methods and inclusion levels of Purge nut (*Jatropha curcas*) and Bitter leaf (*Vernonia amygdalina*) on growth performance of broiler chickens

Parameters	Herb type				Extraction methods				Inclusion levels				
	JPA	BL	SEM	P-value	Hot Water	Ethanol	SEM	P-value	0mL	10mLs	20mLs	SEM	P-value
Initial Wt (g/b)	37.71	38.09	0.25	0.297	37.92	37.87	0.25	0.895	37.43	37.81	38.45	0.31	0.080
Final Wt (g/b)	2516.90^{a}	2435.50^{b}	16.00	0.001	2494.10	2458.30	16.00	0.126	2538.90^{a}	2464.90^{b}	2424.81^{b}	19.60	0.001
WG (g)	2479.20^{a}	2397.40^{b}	16.10	0.001	2456.20	2420.40	16.10	0.129	2501.50^{a}	2427.10^{b}	2386.40^{b}	19.70	0.001
ADWG (g/b/d)	59.03^{a}	57.08^{b}	0.38	0.001	58.48	57.63	0.38	0.129	59.56^{a}	57.79^{b}	56.82^{b}	0.47	0.001
Feed Intake (g)	8693.00	8604.00	134.00	0.644	8672.00	8625.00	134.00	0.806	8500.00	8705.00	8742.00	164	0.541
ADFI (g/b/d)	92.66	90.78	0.95	0.172	91.65	91.79	0.95	0.921	89.57^{b}	91.29^{ab}	94.30^{a}	1.16	0.026
ADWI (mL/b/d)	206.98	204.87	3.19	0.644	206.48	205.36	3.19	0.806	202.38	207.25	208.14	3.91	0.541
FCR	1.57	1.59	0.02	0.478	1.57	1.60	0.02	0.423	1.51^{b}	1.58^{ab}	1.66^{a}	0.0265	0.001

^{ab} means along the same row with different superscript are significantly different (P<0.05); JPA- *Jatropha curcas* extract; BL- Bitter leaf extract; Wgt - Weight; WG – Weight gain; ADWG – Average daily weight gain; ADFI – Average daily feed intake; FCR – Feed conversion ratio; ADWI – Average daily water intake.

Table 2: Effect of Interaction between herb type, extraction methods and inclusion levels of Purge nut (*Jatropha curcas*) and Bitter leaf (*Vernonia amygdalina*) on growth performance of broiler chickens

Parameters	Purge nut						Bitter leaf						SEM	P-value
	Hot water (mL)			Ethanol (mL)			Hot water (mL)			Ethanol (mL)				
	0	10	20	0	10	20	0	10	20	0	10	20		
Initial Wgt (g/b)	37.43	38.43	38.43	37.43	37.19	37.33	37.43	36.71	39.10	37.43	38.91	38.95	0.593	0.130
Final Wgt (g/b)	2538.90	2633.30	2456.70	2538.90	2454.80	2478.60	2538.90	2454.00	2343.90	2538.90	2317.50	2421.10	40.60	0.879
WG (g)	2501.50	2594.90	2418.30	2510.50	2417.60	2441.20	2501.50	2417.30	2303.80	2501.50	2278.60	2382.10	40.90	0.887
ADWG (g/b/d)	59.56	61.78	57.58	59.56	57.56	58.13	59.56	57.55	54.85	59.56	54.25	56.72	0.97	0.887
Feed Intake (g)	8500.00	9331.00	8523.00	8500.00	8765.00	8540.00	8500.00	8236.00	8943.00	8500.00	8486.00	8961.00	328.00	0.0604
ADFI (g/b/d)	89.57	95.74	93.63	89.57	93.79	93.69	89.57	87.87	83.55	89.57	87.78	96.32	2.41	0.921
ADWI (mL/b/d)	202.38	222.18	202.93	202.38	208.68	203.32	202.38	196.10	212.94	202.38	202.05	213.37	7.81	0.604
FCR	1.51	1.55	1.63	1.51	1.63	1.61	1.51	1.53	1.71	1.51	1.62	1.70	0.06	0.998

Wgt - Weight; WG – Weight gain; ADWG – Average daily weight gain; ADFI – Average daily feed intake; FCR – Feed conversion ratio; ADWI – Average daily water intake