



RESEARCH ARTICLE

Effect of different inclusion levels of *Phyllanthus amarus* Leaf Extract on Growth Performance of three strains of Broiler

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Article History: 25-

Received: 15-Jan-2025

Revised: 28-Feb-2025

Accepted: 22-Mar-2025

ABSTRACT

The study involved an eighth week feeding trial conducted to investigate the effect of different inclusion levels of *Phyllanthus amarus* leaf extract on growth performance of three strains of broiler, namely: Arbor acre, Marshall and Ross 308. A total number of one hundred and fifty unsexed broiler chicks were used for the experiment, in a 3 by 4 factorial arrangement. The *Phyllanthus amarus* leaf extract (PALE) was administered at 0%, 15%, 30% and 45%. Ross 308 performed better than the other strains in most of the growth indices studied followed by the Arbor acre, and the least being the Marshall strain. Again, birds on 15% inclusion level of PALE excelled in virtually all the parameters followed by those on 30% PALE inclusion level. Furthermore, those on 0% PALE (control) performed slightly better than those on 45% PALE addition level in few parameters. Generally, pronounced strain x PALE interaction effects were observed in almost all the parameters. Consequently, the study evinced that administration of 15% to 30% PALE enhanced growth performance of broilers irrespective of the strain, and without any deleterious effect on growth indices.

Key words: PALE, broiler strains, growth indices.

INTRODUCTION

The consideration of nutrition as a crucial necessity in any livestock enterprise, cannot be overemphasized, of which the survival of any livestock feed industry is dependent on the availability of feedstuffs, which are mainly components of human food. Grain crops are an important part of the human diet, accounting for a third of the consumed calories (Soto-Gómez & Pérez-Rodríguez, 2022). The stiff competition between man and animal for the never sufficiently available grains, remain a bottle neck constraint to the expansion of commercial poultry production in Nigeria.

Alternative feed additives have pronounced importance in broiler production due to the ban on the use of certain antibiotics. The most applied antibiotic alternatives in the broiler production sector are organic

acids, phytogenics, prebiotics, probiotics, emulsifiers, essential oils, tributyrin, medium-chain fatty acids, enzymes, and their derivatives. Antibiotic alternatives have been reported to increase feed intake, stimulate digestion, improve feed efficiency, increase growth performance, and reduce the incidence of diseases by modulating the intestinal microbiota and immune system, inhibiting pathogens, and improving intestinal integrity (Ayalew et al. 2022; Qidong Zhu et al. 2021). The need to go into antibiotic-free production has motivated scientists to search for alternatives to antibiotics in broiler chicken production. Many strategies can of essence be used to replace the use of antibiotics in broiler production. In recent years, many studies have been conducted to identify functional feed additives with similar beneficial effects as antibiotic growth promoters. One of such which could

Cite This Article as: Effect of different inclusion levels of *Phyllanthus amarus* leaf extract on growth performance of three strains of broiler, 2025. Mba Anthonia Nkiru, Onwumelu I. J., Benjamin N. Emelugo, Chiedo CC, Ezejesi, HC, Ejivade OM and Okonkwo JC. Trends in Animal and Plant Sciences 5: 54-58. <https://doi.org/10.62324/TAPS/2025.064>

be of immense value for poultry feeding is the leaves of the *Phyllanthus amarus*. Proximate analysis showed percentage values of moisture, ash, crude fibre, ether extract, crude protein, nitrogen free extract and carbohydrate contents, of which the mineral composition analysis revealed the presence (mg/l) of major and minor elements, Zn, Fe, Na, Mn, K, Mg, Ca, and Cu, in natural blend (Adebisi et al.2021). These results showed potentials of *P. amarus* leaf samples and suggesting it as a good source for mineral supplementation. These findings may also explain some basis of ant malarial properties of aqueous extract of *P. amarus* leaves. The mineral contents especially potassium with the resultant phyto-chemicals such as phenol, alkaloids, flavonoids, tannins, saponins and oxalate attributes reveals that the *P. amarus* leaves could serve as feed additives in poultry production. *Phyllanthus amarus* is an herbal plant often used for medicinal purposes. The extract contains antibacterial substances; therefore, it can be used to inhibit bacterial growth. Consequently, the provision of herbal plants can allegedly stabilize chickens' health conditions and increase the efficiency of chicken feed (Hidanah et al. 2018; Lee et al. 2016; Zheng et al. 2016).

MATERIALS AND METHODS

The Experimental Site

This study was carried out at the Poultry Section of Animal Science Teaching and Research Farms, Department of Animal Science and Technology, Faculty of Agriculture, Nnamdi Azikiwe University, Akwa, Anambra State, Nigeria. The farm lies in the rainforest region of south - Eastern Nigeria having an average annual rainfall of 1,500mm and mean ambient temperature of about 34°C, on a longitude 7°08'31"E and latitude 6°15'10.1"N.

Experimental Diets

Fresh *Phyllanthus amarus* leaves were collected from Nnamdi Azikiwe University, Awka premises. The freshly harvested *Phyllanthus amarus* leaves were washed, plucked from the stem and finely chopped. 200g of the finely chopped leaves were weighed using electronic balance MT 5000D and milled with clean 600ml distilled water in an electric blending machine Power Deluxe electric blender Model PDB-823I-T. The filtrate was obtained with the aid of cheese cloth during the filtration process. Additional 750ml of water was added with the aid of a measuring cylinder to ensure that all the extracts were removed making a total of 1350ml of

aqueous filtrate and the different treatment percentage was poured accordingly into T₂, T₃ and T₄. The drinkers containing aqueous *Phyllanthus amarus* filtrate and mixture of water were placed in the pens of the replicates allocated to the treatment pen and left in the pens to allow the birds to voluntarily consume as the only source of drinking water.

The Experimental Birds

The experimental animals were procured from AGRITED hatchery Lagos-Ibadan express way, Oyo State through their state distributor and they were transported at the cool hour of the day to minimize transportation stress.

A total of one hundred and fifty (150) day old broiler chicks (Ross 308, Marshall and Arbor acre breeds) used for the experiment were randomly distributed into four treatment groups of 50 chicks per group. Each treatment group had three replicates, with 10 chicks per replicate such that the only source of variation is the aqueous *P. amarus* leaf extract treatment in a completely randomized design (CRD). Birds in treatment one (T₁) was the control (0%), while birds in treatments 2, 3 and 4 (T₂, T₃ and T₄) were subjected to aqueous extract treatment at concentration of, 15ml, 30ml and 45ml. The broiler chicks were managed on deep-litter.

RESULTS AND DISCUSSION

The results of the effects of broiler strain on the growth performance at 7 weeks of age, is shown in Table 1. There is a significant difference ($P < 0.05$) among the three strains of broilers in average daily weight gain, average daily feed intake, feed conversion ratio and final body weight gain. In the average daily weight gain and Average daily feed intake (g), Ross has the highest mean value (44.74 and 133.98 respectively) followed by Arbor acre (38.24 and 106.36 respectively) while the least average daily weight gain and average daily feed intake was recorded in Marshall (34.11 and 100.93 respectively). There is a significant difference ($P < 0.05$) between Ross and Marshall in the Average daily weight gain and feed intake.

Ross has highest mean value in the feed conversion ratio (2.99), followed by Marshall (2.95) which is significantly different from the feed conversion ratio in Arbor Acer which has the least mean value (2.75) in the feed conversion ratio. For the final body weight, Arbor Acer has the highest final body weight (1987), followed by Ross (1944), and while the least final body weight

Table 1: The effects of broiler strain on the growth performance at 7 weeks of age.

Parameter	Marshall	Ross 308	Arbor Acer	SEM	P value
Average daily weight gain	34.11 ^a	44.74 ^c	38.24 ^b	0.29	0.00
Average daily feed intake (g)	100.93 ^a	133.98 ^c	106.36 ^b	0.09	0.00
Feed Conversion Ratio	2.95 ^b	2.99 ^c	2.75 ^a	0.01	0.00
Final body weight	1756 ^a	1944 ^b	1987 ^c	1.45	0.00

Note. ^{abcd} Means on the same row followed by different superscripts are significantly different ($P < 0.05$); SEM – Standard Error of Mean.

Table 2: Effect of various levels of inclusion of *Phyllanthus amarus* extract on growth performance of broiler at 7 weeks of age.

Parameter	T1 (0.0 ml)	T2 (15 ml)	T3 (30 ml)	T4 (45 ml)	SEM	P value
Average Daily Weight Gain	37.23 ^b	42.43 ^d	41.17 ^c	35.31 ^a	0.34	0.00
Average Daily Feed Intake (g)	110.62 ^b	119.20 ^d	118.18 ^c	106.22 ^a	0.10	0.00
Feed Conversion Ratio	2.93 ^b	2.81 ^a	2.84 ^a	2.99 ^c	0.02	0.00
Final Body Weight	1881 ^b	1927 ^d	1915 ^c	1858 ^a	1.67	0.00

Note. ^{abcd} Means on the same row followed by different superscripts are significantly different ($P < 0.05$); SEM – Standard Error of Mean.

was recorded in Marshall (1756). There is a significant difference ($P < 0.05$) between Arbor Acer (1987), Ross (1944), Marshall (1756) in the Final body weight respectively.

There is a significant difference between T1 (0.0ml), T2 (15ml), T3 (30ml), and T4 (45ml). In the average daily weight gain, T2 (42.43) has the highest mean value which is significantly different ($P < 0.05$) from T3 (41.17), T4 (35.31), and T1 (37.23), of which T4 (35.31) has the least value. In the Average daily feed intake (g), T2 (119.20) has the highest value, followed by T3 (118.18), T1 (110.62), T4 (106.22), which has the lowest mean value. Hence, there is a significant difference ($P < 0.05$) between T1 (110.62), T2 (119.20), T3 (118.18) and T4 (106.22). The highest feed conversion ratio was recorded in T4 (2.99). There is a significant difference ($P > 0.05$) between T4 (2.99) and T1 (2.93), and likewise between T2 (2.81), T1 (2.93), T4 (2.99). But there is no significant difference ($P > 0.05$) between T2 (2.81) and T3 (2.84), of which, the least feed conversion ratio was recorded in T2. (2.81). For the final body weight, there is a significant difference ($P < 0.05$) between T1 (1881), T2 (1927), with the highest body weight T3 (1915), and T4 (1858) the least final body weight and T2 (1927). Nguyen et al. (2012) reported that using different levels (0.25 to 1.5%) of *Phyllanthus amarus* powder in the diets had no effects on the growth performance of chicken.

There are significant differences in the average daily weight gain and feed intake of Marshall among the four treatment levels. In the average daily weight gain and feed intake of Marshall, T3 was recorded the highest which was significantly different ($P < 0.05$) from T1 which is the control. The least average daily weight gain and feed intake of Marshall was recorded in T4 which is significantly different ($P < 0.05$) from T2.

The feed conversion ratio of Marshall among the four treatment showed that the highest feed conversion ratio was recorded in T4 (3.17) followed by T1 (3.01) which is significantly different ($P < 0.05$) from T3 (2.73) the least, and the best feed conversion ratio in Marshall. The highest final body weight of Marshall in the treatments was recorded in T3 (1820) which is significantly different ($P < 0.05$) from T1 (1728) which is the control. The least final body weight of Marshall was recorded in T4 (1685) that is significantly different from T2 (1790). Ross strain was reported to have a feed conversion ratio 1.98 at 4th week.

The average daily weight gain of Ross in the four treatments showed that the highest mean value was recorded in T2 (48.45) which is significantly different

($P < 0.05$) from T1 (42.86) which is the control but there is no significant different ($P > 0.05$) between T2 (48.45) and T3 (47.11) and the least average daily weight gain was recorded in T4 (40.55).

In Ross, the highest average daily feed intake was recorded in T2 (142.02) followed by T3 (138.06) which is significantly different from T1 (130.66) which is the control and the least average daily feed intake was recorded in T4 (125.17). The feed conversion ratio of Ross among the treatments showed that the highest FCR was recorded in T4 (3.08) while the least FCR was recorded in T2 (2.91) which is significantly different ($P < 0.05$) from T1 (3.04) which is the control but there is no significant different ($P > 0.05$) between T2 (2.91) and T3 (2.92). The highest final body weight of Ross in the four treatments was recorded in T2 (1963) that is significantly different ($P < 0.05$) from T1 (1945) which is the control but there is no significant difference between T1 (1945) and T3 (1945). The least final body weight of Ross among the treatments was recorded in T4 (1923).

The highest average daily weight gain in Arbor Acre was recorded in T2 (43.00) which was significantly different ($P < 0.05$) from T1 (36.67) which is the control but there is no significant difference ($P > 0.05$) between T1 (36.67) and T3 (35.93) and the least average daily weight gain was recorded in T4 (35.93). The Average daily feed intake of Arbor Acre among the four treatments reviewed that the highest average daily feed intake was recorded in T2 (114.70) that is significantly difference ($P < 0.05$) from T1 (102.06) which is the control, and the least average daily feed intake was recorded in T4 (98.71) which is significantly different from T3 (109.98).

The feed conversion ratio of Arbor Acre in the four treatments showed that the highest feed conversion was recorded in T3 (2.88) which is no significantly different ($P > 0.05$) from T1 (2.75) which is the control while the least feed conversion ratio was recorded in T2 (2.65) that is significantly different from T1 (2.75) which is the control. The highest final body weight among the treatments was recorded in T2 (2029) which is significantly different ($P < 0.05$) from T1 (1971) and the least final weight gain of Arbor Acre was recorded in T4 (1967) which is significantly different ($P < 0.05$) from T3 (1980) The present study demonstrated that broiler growth performance was significantly influenced by both genetic strain and dietary levels of *Phyllanthus amarus* leaf extract (PALE). Ross 308 and Arbor Acre strains consistently outperformed the Marshall strain in terms of average daily gain (ADG), feed intake (ADFI),

Table 3: Marshall x Extract interaction

Strain	Parameter/Extract	T1 (0.0ml)	T2 (15ml)	T3 (30ml)	T4 (45ml)	SEM	P value
Marshall	Average Daily weight gain	32.16 ^b	35.83 ^c	39.01 ^d	29.45 ^a	0.59	0.00
	Average Daily feed intake (g)	99.15 ^b	103.28 ^c	106.52 ^d	94.78 ^a	0.18	0.00
	Feed conversion ratio	3.01 ^c	2.87 ^b	2.73 ^a	3.17 ^d	0.03	0.00
	Final body weight	1728 ^b	1790 ^c	1820 ^d	1685 ^a	2.90	0.00

Note. ^{abcd} Means on the same row followed by different superscripts are significantly different (P<0.05); SEM – Standard Error of Mean.

Table 4: Ross x Extract interaction

Strain	Parameter/Extract	T1 (0.0ml)	T2 (15ml)	T3 (30ml)	T4 (45ml)	SEM	P value
Ross	Average Daily weight gain	42.86 ^b	48.45 ^c	47.11 ^c	40.55 ^a	0.59	0.00
	Average Daily feed intake (g)	130.66 ^b	142.02 ^d	138.06 ^c	125.17 ^a	0.18	0.00
	Feed conversion ratio	3.04 ^b	2.91 ^a	2.92 ^a	3.08 ^c	0.03	0.00
	Final body weight	1945 ^b	1963 ^c	1945 ^b	1923 ^a	2.90	0.00

Note. ^{abcd} Means on the same row followed by different superscripts are significantly different (P<0.05); SEM – Standard Error of Mean.

Table 5: Arbor Acre x Extract interaction

Strain	Parameter/Extract	T1 (0.0ml)	T2 (15ml)	T3 (30ml)	T4 (45ml)	SEM	P value
Arbor Acre	Average Daily weight gain	36.67 ^{ab}	43.00 ^b	37.38 ^{ab}	35.93 ^a	0.59	0.00
	Average Daily feed intake (g)	102.06 ^b	114.70 ^d	109.98 ^c	98.71 ^a	0.18	0.00
	Feed conversion ratio	2.75 ^c	2.65 ^a	2.88 ^c	2.73 ^b	0.03	0.00
	Final body weight	1971 ^b	2029 ^d	1980 ^c	1967 ^a	2.90	0.00

Note. ^{abcd} Means on the same row followed by different superscripts are significantly different (P<0.05); SEM – Standard Error of Mean.

and final body weight (FBW), which is consistent with findings by Unigwe et al. (2020), who reported that Ross broilers exhibited higher feed efficiency and growth potential compared to local breeds. Birds administered with 15 ml and 30 ml PALE showed enhanced ADG and FCR, with 15 ml being the most effective inclusion level. These results align with the findings of Agbalaya et al. (2024), who reported that low doses of *Phyllanthus amarus* enhanced carcass yield and intestinal health without negatively affecting growth performance. Similarly, Oloruntola et al. (2022) demonstrated that phytogenic feed additives improved growth indices in broilers through gut health modulation and enhanced nutrient utilization. The reduced performance observed at 45 ml inclusion level may be attributed to excessive levels of bioactive compounds interfering with nutrient absorption or feed palatability. Hidanah et al. (2018) suggested that high doses of herbal extracts such as *P. amarus* could potentially exert immunological stress or disrupt gastrointestinal balance.

Strain × PALE interaction further revealed strain-specific responses. Ross 308 was most responsive to 15 ml PALE, while the Marshall strain benefited more from the 30 ml level. These differences underscore the need for genotype-specific feeding strategies. According to Amad et al. (2011), the effects of phytogenic additives depend heavily on bird genotype, age, and gut microbiota composition.

Phytochemicals present in PALE such as flavonoids, alkaloids, and tannins likely contributed to the observed improvements, acting as natural growth promoters by stimulating digestive enzymes and reducing pathogenic load. Lee et al. (2016) and Adebisi et al. (2021) have both reported similar benefits from *Phyllanthus* species in livestock nutrition. Moderate

PALE inclusion (15–30 ml) can serve as an effective phytogenic growth promoter in broilers, particularly in genetically superior strains.

Conclusion and Recommendations

From this study, it was concluded that Arbor acre strain performed better than the other strains, as there were significant interaction observed in terms of ADWG, FI, FCR and FBW. Also from this study it can be concluded that *Phyllanthus amarus* when administered in diet may hamper growth rate of broiler chicken especially when above 15 ml. However, inclusion of *Phyllanthus amarus* extract at levels used in this study did not have any adverse effect on health of the birds. The following recommendations are thereby proffered for the use of *Phyllanthus amarus*:

- *Phyllanthus amarus* extract inclusion in broiler diet is therefore recommended at low dose to improve the performance of broiler.
- *Phyllanthus amarus* extract for the eradication toxicity in broiler birds can be considered after considering margin of economic returns.
- Research to further evaluate the efficacy of *Phyllanthus amarus* extract on the growth performance of poultry should be carried out and other parts of the plant.

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