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PERFORMANCE AND ECONOMICS OF PRODUCTION OF BROILER CHICKENS FED DIFFERENT DIETARY LEVELS OF BITTER LEAF (*Vernonia amygdalina*) MEAL

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Bitter leaf, Broilers, Cost, Feed, Revenue, Weight gain,

ABSTRACT
The study was conducted to determine the effect of varying dietary levels of bitter leaf (Vernonia amygdalina) meal (BLM) on the performance and economics of production of broiler chickens. A total of ninety-six (96), 28-day old broiler chickens were used in a Completely Randomised Design experiment. The chickens were randomly allocated to four dietary treatment groups with commercial diets supplemented with BLM at the rate of 0g/kg of feed, 25g/kg of feed. 50g/kg of feed and 75g/kg of feed designated as T1, T2, T3 and T4 respectively. Performance parameters measured were weight gain, daily feed intake and feed conversion ratio while the parameters of economics of production measured were feed cost per bird, cost of feed /kg gain, benefit cost ratio, cost of production and revenue. Results showed significant ($p<0.05$) treatment effects on final body weight, weight gain, daily feed intake, feed conversion ratio and the economic parameters of feed cost/kg gain, cost of production, total revenue and benefit cost ratio. It was concluded that bitter leaf meal inclusion in the diet of broiler chickens improved their performance and economic yield. It was recommended that bitter meaf meal be included in the diet of broiler chickens up to 75g/kg of feed.

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INTRODUCTION

One of the most profitable agro-industries capable of effectively addressing unemployment challenges in rural areas is the poultry sector (Oyewole et al., 2023; Singh, 2010). The poultry industry is adaptable to a wide range of climatic conditions and can generally be integrated easily with other farming activities. Despite experiencing slow growth over the past two decades, there remains a substantial gap between the demand for and availability of poultry products (Zekeri et al., 2022; Singh, 2010).

Adeniji and Balogun (2002) emphasized that improving animal protein consumption among the average Nigerian population requires increased production of highly productive animals with short generation intervals, such as poultry, pigs, rabbits, sheep, and goats. To achieve this, promoting broiler production becomes crucial. Broiler production generates employment opportunities and consistent income within a short period due to the birds' rapid growth and shorter production cycles. However, profitability can only be guaranteed when production costs are minimized, as net profit is directly influenced by gross returns and cost of production. While reducing production costs is desirable for increased profit, care must be taken not to compromise the quality attributes of broiler meat such as tenderness and softness.

It is well known that feed constitutes the largest and most expensive input in livestock farming, particularly in poultry enterprises. Therefore, any meaningful reduction in feed costs will significantly lower total production expenses and improve the farmer's profit margin (Owen & Amakiri, 2011). Given the rising costs of conventional protein sources such as fish meal, groundnut cake, and soybean, along with restrictions on synthetic feed additives, recent nutritional research has focused on exploring non-conventional feed ingredients and locally available natural alternatives with low competition from human consumption (Okpe & Abdulfatai, 2022; Owen, 2011). One such promising natural additive that could help reduce feed costs in poultry production is bitter leaf (*Vernonia amygdalina*) meal.

Vernonia amygdalina is a shrub or small tree widely distributed across tropical Africa. It is commonly referred to as "bitter leaf" due to its high concentration of bitter compounds (Ekpo et al., 2007). The leaves contain notable levels of anti-nutritional factors such as tannins and saponins. According to Akwaowo et al. (2000), the young leaves, often preferred for human

consumption, contain relatively high concentrations of cyanide (60.1 mg/100 g DM) and tannins (40.6 mg/100 g DM) compared to the older leaves.

The proximate analysis of *Vernonia amygdalina* leaf meal (VALM) reveals the following nutritional profile: metabolizable energy (ME) of 527.83 kcal/kg, 86.40% dry matter (DM), 21.50% crude protein (CP), 13.10% crude fiber (CF), 6.80% ether extract (EE), and 11.05% ash. Its mineral composition includes 3.85% calcium, 0.40% magnesium, 0.03% phosphorus, 0.006% iron, 0.33% potassium, and 0.05% sodium (Owen, 2011). Moreover, *Vernonia amygdalina* has been successfully incorporated into broiler diets, replacing up to 300 g/kg of maize-based feed without negatively affecting feed intake, body weight gain, or feed conversion efficiency (Bonsi et al., 1995).

Studies have also reported the beneficial roles of bitter leaf in poultry health management (Dakpogan, 2006), including anti-coccidial, anti-bacterial, and anti-parasitic effects (Gbolade, 2009; Tadesse et al., 1993). Additionally, it possesses antioxidant properties (Erasto et al., 2007) and acts as a natural growth promoter by stimulating gastrointestinal enzymes and enhancing feed conversion efficiency (Huffman et al., 1996; Olobatoke & Oloniruha, 2009). Therefore, the objective of this study was to determine the effects of different dietary inclusion levels of bitter leaf meal on the performance and production economics of broiler chickens.

METHODOLOGY

Experimental Site

The study was conducted at the Poultry Unit of the Teaching and Research Farm, Department of Animal Production, Kogi State University, Anyigba, located in Dekina Local Government Area of Kogi State. Anyigba lies at Latitude 7°30'N and Longitude 7°09'E, with an average elevation of 420 meters above sea level. The region is situated within the tropical wet-and-dry climatic zone of the Guinea savanna, characterized by an average annual rainfall of approximately 1600 mm and a daily temperature range of 25°C to 35°C (Aderibigbe et al., 2022).

Processing of Materials

Fresh leaves of *Vernonia amygdalina* were harvested and air-dried under shade to maintain their green coloration. After achieving practical dryness, the leaves were milled and stored for subsequent use.

Experimental Birds and Management

A total of ninety-six (96) four-week-old broiler chickens were utilized for this experiment. Prior to the trial, the birds were fed a standard commercial broiler starter diet and vaccinated against Newcastle disease using the Lentogenic strain (LaSota). Upon arrival, anti-stress agents (glucose and Vitalyte), vitamins, and antibiotics were administered through their drinking water. Additionally, the birds were dewormed and treated with antibiotics before the onset of the feeding trial. At four weeks of age, the birds were randomly distributed into four dietary treatments, each receiving a commercial broiler diet supplemented with *Vernonia amygdalina* (bitter leaf) meal at inclusion levels of 0 g/kg, 25 g/kg, 50 g/kg, and 75 g/kg of feed, designated as T1, T2, T3, and T4, respectively.

Economic parameters*:*

These were determined according to the methods of Orheruata *et al*. (2005) and Cam (2014) as follows:

i. Feed cost/bird (N) = $\frac{\text{Cost of feed consumed}}{\text{Number of birds}}$
ii. Cost of feed/kg gain = Feed cost/kg x FCR
iii. Benefit cost ratio (BCR) = $\frac{\text{Total Revenue}}{\text{Total Cost}}$
iv. Cost of production = Total Variable Cost
v. Revenue = Final body weight × Cost/kg liveweight.

Parameters measured

Performance parameters:

The performance parameters measured were weight gain, daily feed intake and feed conversion ratio.

i. Weight gain = Weight gain was computed by subtracting initial body weight from final body weight.
ii. Daily feed intake = This was done by deducting the weight of remnant feed from the feed offered the previous day.
iii. Feed conversion ratio = This was computed as ratio of feed consumed to weight gain

Statistical Analysis

Data collected were analyzed using analysis of variance (ANOVA) with the aid of the Statistical Package for Social Sciences (SPSS), version 20. Where significant differences occurred, treatment means were separated using the Least Significant Difference (LSD) test.

RESULTS

The effects of BLM on the performance of broiler chickens are shown in Table 1. The findings indicated that final body weight, weight gain, daily feed intake, and feed conversion ratio were significantly ($P < 0.05$) influenced by the The influence of bitter leaf meal on the economic performance of broiler production is presented in Table 2. The results revealed that economic indices such as feed cost per kilogram of weight gain, cost of production, total revenue, and benefit-cost ratio were significantly ($P < 0.05$) affected by the dietary treatments. The highest values for benefit-cost ratio, total revenue, and production cost were recorded in birds fed diets containing 75 g/kg BLM, followed by those fed 50 g/kg and 25 g/kg BLM, respectively. Birds in the control group had the lowest values across these economic parameters.

Table 1: Effect of Bitter Leaf Meal on the Performance of Broiler Finisher Chickens

Parameters	Levels of inclusion					
	T2 (0g/kg)	T3 (25g/kg)	T4 (50g/kg)	T1 (75g/kg)		
Initial Body Weight (g)	1021.49	1027.72	1037.54	1032.50	12.28	NS
Final Weight (g)	2583.33^{d}	2712.50^{c}	2835.83^{b}	2945.00^{a}	32.79	*
Total Weight Gain (g)	1561.59^{d}	1684.95^{c}	1798.46^{b}	1912.25^{a}	32.71	*
Total Feed Intake (g)	2856.33^{c}	3142.00^{b}	3351.00^{a}	3389.00^{a}	60.27	*
Feed Conversion Ratio	1.82^{b}	1.86^{a}	1.79^{c}	1.76^{d}	0.02	*

*^{a,b,c,d}Means with different superscript on the same row differ significantly (P<0.05), SEM = Standard Error of Mean, LOS = Level of Significance, NS = Not Significant (p>0.05), *Significant (p<0.05).*

Table 2: Effect of Bitter Leaf Meal on the Economics of Production of Finisher Broiler Chicken

Parameters	**Levels of Inclusion**				**SEM**	**LOS**
	T1 (0g)	**T2 (25g)**	**T3 (50g)**	**T4 (75g)**		
Cost of feed/kg	270.83	270.83	270.83	270.83	0.01	NS
Feed Cost/Kg Gain (₦)	492.91^{b}	503.74^{a}	484.79^{c}	476.66^{d}	5.78	*
Cost of Production(₦)	822.91^{d}	840.39^{c}	860.18^{b}	881.23^{a}	12.58	*
Total Revenue(₦)	2193.83^{d}	2305.63^{c}	2410.46^{b}	2503.25^{a}	66.74	*
Cost Benefit Ratio	2.67^{d}	2.74^{c}	2.80^{b}	2.84^{a}	0.04	*

Cost of production = Cost of feed + Cost of medication + Cost of day-old chick, Revenue based on ₦850/kg live weight.
*^{a,b,c,d}Means with different superscript on the same row differ significantly (P<0.05), SEM = Standard Error of Mean, LOS = Level of Significance, NS = Not Significant (p>0.05), *Significant (p<0.05).*

DISCUSSION

The overall improvement in final live weight and weight gain of birds fed bitter leaf meal in this study suggests that bitter leaf meal enhanced the growth performance of broiler chickens. The superior performance observed in birds fed 75g/kg of feed may be due to increased secretion of digestive enzymes and enhanced nutrient utilization in the liver (Durunna et al., 2011). The antibacterial properties of essential compounds in medicinal plants may inhibit the growth of pathogenic bacteria while promoting beneficial probiotic bacteria in the gut (Bonsi et al., 1995). This may explain why medicinal plants can serve as alternatives to antibiotic growth promoters, as they possess antimicrobial properties and can play a vital role in poultry nutrition (Mohammed and Zakariya, 2012).

The significantly improved feed conversion ratio (FCR) observed in T4 could be attributed to the higher weight gain recorded in birds on this diet. This result aligns with the findings of Olobatoke and Oloniruha (2009), who reported that incorporating *Vernonia amygdalina* powder in cockerel diets significantly enhanced FCR. This may be linked to its effect on boosting

gastrointestinal enzyme activity, thereby improving digestion and nutrient assimilation (Adaramoye et al., 2008). The results of this study are also supported by Windisch (2007), who reported improved growth performance in chickens fed *Vernonia amygdalina*. According to Mohammed and Zakariya (2012), phytogenic feed additives are often associated with enhanced feed flavor and palatability; thus, bitter leaf extract may improve bird performance by encouraging better feed intake. This could have contributed to the enhanced performance of chickens fed bitter leaf meal in this study. Improved intestinal health likely reduced exposure to microbial toxins and undesirable metabolites such as ammonia and biogenic amines. As a result, the chickens were probably less burdened by immune defence stress during critical periods, allowing for better availability and absorption of essential nutrients, and enabling them to achieve optimal growth according to their genetic potential (Erasto et al., 2007).

The significant reduction in feed cost per kilogram of weight gain with increasing levels of bitter leaf meal demonstrates that including bitter leaf meal in broiler finisher diets may enhance profitability. This finding aligns with the reports of Okpe and Gata (2025), Mohammed and Zakariya (2012) and Odunsi (2003), who observed that supplementing poultry diets with leaf meals could reduce production costs and increase profit margins.

The benefit-cost ratio recorded is comparable to that reported by Makinde (2012). Birds in T4 (75g BLM) had the highest benefit-cost ratio of 2.84, indicating that for every ₦1 spent, a return of ₦2.84 was realized, compared to ₦2.67 in birds on the control diet. This suggests that feeding bitter leaf meal to broilers could be economically advantageous.

CONCLUSIONS

The results of this experiment indicate that the inclusion of bitter leaf meal in broiler finisher diets had no adverse effect on the performance of broiler chickens. Based on economic principles, the supplementation of bitter leaf meal in broiler diets is advisable, as it proved to be economically beneficial.

RECOMMENDATION

Based on the findings of this study, it is recommended that bitter leaf meal be included in broiler chicken diets at levels up to 75 g/kg of feed to enhance productivity.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this article.

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