

Performance and economy of broiler chicken fed diets containing graded levels of wild aerial yam (*Dioscorea bulbifera*) meal (WAYM)

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ABSTRACT: The search for alternative feed ingredients has become increasingly important due to the rising cost of conventional energy sources in poultry production. A study was conducted to evaluate the growth performance and economic implications of feeding broiler chickens' diets containing graded levels (0%, 5%, 10%, and 15%) of wild aerial yam meal (WAYM). Ninety-six-day-old Abor Acre broiler chicks were randomly assigned to four dietary treatments with three replicates in a completely randomised design and reared for 42 days under standard management conditions. Growth performance and economic indices were assessed. Results showed significant ($p < 0.05$) differences in weight gain, feed intake, feed conversion ratio, mortality, feed cost, revenue, and gross margin among treatments. Growth performance declined as the level of WAYM increased, likely due to residual anti-nutritional factors such as dioscorine, oxalate, and saponins, which may have reduced feed palatability and nutrient utilisation. Although feed cost per kilogram decreased with increasing WAYM inclusion, revenue and gross margin were also reduced. Birds fed diets containing 0% and 5% WAYM recorded superior economic returns, characterised by lower feed cost per kilogram of gain and higher gross margins. It was concluded that WAYM can be included in broiler diets at up to 5% without adverse effects on profitability, while higher inclusion levels require improved detoxification before use.

Keywords: Broiler chicken, economy, performance, wild aerial yam.

INTRODUCTION

The poultry industry is facing significant challenges due to the shortage and high cost of feed ingredients, particularly grains. Maize, the primary energy source in monogastric animal diets in Nigeria, takes up to 60% of the ration but has become so expensive due to scarcity and increasing demand by humans and livestock (Ebong *et al.*, 2023; Sam *et al.*, 2023; Essien *et al.*, 2022).

Feeding is a critical aspect of raising chickens, accounting for the major cost of production. Good nutrition impacts the performance and product quality of livestock directly. Therefore, high-quality poultry feed should be formulated to provide the appropriate nutrients required for the specific strains of birds raised, using safe and

acceptable ingredients in a manageable physical form (Ukpanah *et al.*, 2025).

The rising cost of conventional feed ingredients and the need to utilise locally available feed ingredients have spurred the adoption of non-conventional feedstuffs in poultry production. To address the high cost and scarcity of conventional feed resources, researchers have increasingly explored non-conventional feedstuffs that are not directly consumed by humans (Ekpo *et al.*, 2020; Ukpanah *et al.*, 2022).

One such alternative is wild aerial yam meal (WAYM), locally known as Ukad ekpo in Efik, which is in abundance, not consumed by humans, rich in some nutrients, and

often wasted (Jirovetz *et al.*, 2023). Processed wild aerial yam meal contains 11.63% crude protein, 4.10% crude fibre, and 66.53% nitrogen-free extract (Udo *et al.*, 2024b). This study seeks to evaluate the growth performance and economy of production of broiler chickens fed diets containing graded levels of wild aerial yam meal.

MATERIALS AND METHODS

Experimental location

This study was carried out at the Teaching and Research Farm, Department of Animal Science, Faculty of Agriculture, Akwa Ibom State University, Obio Akpa Campus. Obio Akpa is located between latitudes 4°30'N and 5°00'N and longitudes 70°30'E and 80°00'E. The area is characterised by an annual rainfall ranging from 3500-5000 mm and an average monthly temperature of 25°C, and relative humidity between 60-90 %. It is in the tropical rainforest zone of Nigeria. The people in the study area depend mostly on livestock and crop production (Udom *et al.*, 2024).

Source and processing of wild aerial yams

The mature wild aerial yam tubers were harvested from fallow farmlands within the Akwa Ibom State University, Obio Akpa Campus environment. They were peeled, sliced, washed and introduced into a cooking pot with water at its boiling point (100°C) and were allowed to boil for 30 minutes, after which the water was decanted, and the wild aerial yam was sundried for ten (10) days. They were then milled to obtain the wild aerial yam meal (WAYM). This was stored in an airtight container to prevent moisture.

Experimental diets

Four diets, T₁, T₂, T₃, and T₄, were formulated with the inclusion of WAYM at 0%, 5%, 10% and 15%, respectively, to replace maize as presented in Table 1.

Experimental birds and management

Ninety-six (96) day-old (Abor Acre) broiler chickens were procured for the experiment. The birds were brooded together for two weeks, after which they were allotted into four treatments with 24 birds each, having three replicates (8 birds per replicate) in a completely randomised design (CRD). The birds were managed in a deep litter pen. Feed and clean water were provided *ad libitum*. Routine management practices in terms of sanitation, medication and vaccination were strictly adhered to.

Data collection

Growth performance

Initial body weight, weight gain, feed intake, feed conversion ratio and mortality were collected. Weight gain was obtained by subtracting initial body weight from the final body weight, and feed intake was obtained by subtracting feed not consumed from the quantity of feed offered. The feed conversion ratio was obtained by dividing the feed intake by the weight gain, and mortality was noted.

Economics of production

The cost of feed was calculated based on the prices of ingredients purchased for diet formulation. Cost/kg of feed was calculated as the total cost of production of 100 kg of feed divided by 100. The cost of feed consumed (N) was calculated as the cost/kg of feed x total feed intake. Cost/kg weight gain was calculated as the cost of feed consumed/total weight gain(kg). Cost of production (N) was calculated as cost/kg weight gain x mean weight gain. Revenue was calculated as the price of 1 kg of chicken (N) x mean weight gain, while the Gross margin was calculated as revenue (N) minus cost of production (N).

Statistical analysis

The data obtained were subjected to analysis of variance (ANOVA) using the General Linear Model Procedure of SPSS (2008). Means with significant differences were separated using Duncan's Multiple Range Test.

RESULTS AND DISCUSSION

Growth performance

The growth performance of broiler chickens fed diets containing graded levels of wild aerial yam meal (WAYM) is presented in Table 2. The results showed that the final body weights of the birds were significantly ($p < 0.05$) lower, reducing from T₁ (2,233.34 g) to T₄ (1,200.00 g). The total weight gain decreased with an increase in the inclusion levels of WAYM. This could be as a result of some heat-stable anti-nutritional factors (primarily dioscorine and oxalates) present in WAYM. Significant reductions were observed by Esonu *et al.* (2006) at 20–30% sun dried aerial yams and by Udo *et al.* (2025) from 15% raw aerial yams, confirming toxicity beyond 10% inclusion. Similar significant reductions were reported by Jiwuba *et al.* (2016) using processed aerial yams at 15% in the diet of broiler chickens.

Table 1. Composition of experimental diets.

Ingredients	T ₁ (0%)	T ₂ (5%)	T ₃ (10%)	T ₄ (15%)
Maize	55.00	50.00	45.00	40.00
Wild aerial yam meal	0.00	5.00	10.00	15.00
Soybean	20.00	20.00	20.00	20.00
Full fat soya	10.00	10.00	10.00	10.00
Fish meal	5.00	5.00	5.00	5.00
Wheat offal	6.10	6.10	6.10	6.10
Limestone	1.50	1.50	1.50	1.50
Bone meal	1.50	1.50	1.50	1.50
Common salt	0.25	0.25	0.25	0.25
Vitamin/mineral premix	0.25	0.25	0.25	0.25
Lysine	0.20	0.20	0.20	0.20
Methionine	0.20	0.20	0.20	0.20
Total	100.00	100.00	100.00	100.00
Calculated analysis				
Crude protein (%)	21.81	22.12	22.44	22.70
Metabolizable Energy (Kcal/kg)	3,546.45	3,033.7	3,028.6	3,530.7

Table 2. Growth performance of broiler chicken fed diets containing graded levels of wild aerial yam (*Dioscorea bulbifera*) meal (WAYM).

Parameters	T ₁ (control)	T ₂ (5 %)	T ₃ (10 %)	T ₄ (15 %)	SEM
Initial Weight(g)	460.43	477.17	460.40	460.47	6.17
Final weight(g)	2233.34 ^a	1933.34 ^b	1666.67 ^c	1200.00 ^d	118.99
Weight gain (g)	1760.90 ^a	1472.84 ^b	1206.27 ^c	733.54 ^d	118.23
Daily Weight (g)	31.66 ^a	26.30 ^b	21.54 ^c	13.09 ^d	2.14
Total feed intake (g)	3135.00 ^a	2965.00 ^a	2633.34 ^b	2200.00 ^c	111.09
Daily feed intake (g)	55.98 ^a	52.98 ^a	47.04 ^b	39.28 ^c	1.99
Feed conversion ratio	1.79 ^c	2.08 ^{bc}	2.19 ^b	3.04 ^a	0.17

a, b, c means on the same rows with different superscripts are significantly different (P<0.05). SEM= standard error of mean.

The total feed intake reduced significantly ($p<0.05$) from 3,135 g (T₁) to 2,200 g (T₄). This depression in feed consumption with increasing levels of WAYM is consistent with the presence of anti-nutritional factors (particularly dioscorine and dihydro-dioscorine) that impart bitterness and reduce palatability (Afolabi *et al.*, 2024). Comparable reductions in feed intake have been documented when raw or inadequately processed yam species (*D. rotundata*, *D. alata*, and *Dioscorea bulbifera*) were incorporated into poultry diets (Jiwuba *et al.*, 2016).

Total body weight gain decreased significantly ($p<0.05$) from 1.76 kg in the control to 0.73 kg in treatment four. The poor weight gain was associated with reduced feed intake and reduced nutrient intake.

Feed conversion ratio, which represents the feed intake divided by the weight gain, deteriorated significantly ($p<0.05$) from 1.79 (T₁) to 3.04 (T₄), with values above 5% inclusion exceeding acceptable commercial limits (>2.0).

The poor feed conversion ratio could be a result of the significant reduction in weight gain, which may be due to impaired nutrient utilisation due to the presence of some anti-nutrients. Similar results were observed by Esonu *et al.* (2006), and Udo *et al.* (2024a) at comparable and higher inclusion levels. This implies that WAYM could be introduced to broiler diets at levels not exceeding 5% in broiler finisher diets.

Economy of production

The economics of broiler chicken fed diets containing graded levels of wild aerial yam meal (WAYM) is presented in Table 3. The cost per kg of feed ranged from ₦1,146.55 to ₦1,229.88 across the treatment groups. There were no significant ($p<0.05$) differences in the cost per kg of feed. The total feed intake declined significantly ($p<0.05$) from

Table 3. Economy of broiler chicken fed diets containing graded levels of wild aerial yam meal (WAYM).

Parameters	T1	T2	T3	T4	SEM	P-value
Cost/kg of feed	1,346.55	1,229.88	1,120.80	1,050.15	18.11	0.065
Feed intake (kg)	3.14 ^a	2.97 ^a	2.63 ^b	2.20 ^c	0.36	0.001
Cost of feed consume (N)	3,600.19 ^a	2,652.74 ^c	3,234.58 ^b	2,705.67 ^c	56.31	0.002
Total weight gain (kg)	1.76 ^a	1.47 ^b	1.21 ^b	0.73 ^c	0.01	0.000
Cost /kg/weight gain (N)	2,045.55 ^b	1,804.59 ^c	2,673.21 ^b	3,706.39 ^a	15.21	0.021
Cost of production (N)	3,600.17 ^a	2,652.74 ^c	3,234.58 ^b	2,705.67 ^c	11.83	0.010
Price/kg of meat (N)	3,000.00	3,000.00	3,000.00	3,000.00	0.000	0.127
Revenue (N)	5,280.00 ^a	4,410.00 ^b	3,630.00 ^c	2,190.00 ^d	16.21	0.001
Gross margin (N)	1,697.83 ^b	1,757.26 ^a	395.42 ^c	-5,15.67 ^d	1.92	0.000

3.14 kg (T₁) to 2.20 kg (T₄).

Despite the higher unit cost of diets containing *Dioscorea bulbifera*, the total cost of feed consumed was significantly lower ($p < 0.05$) in groups fed 2.63 kg and 2.20 kg (₦3,234.58 and ₦2,705.67, respectively) than the control (₦3,600.19). This paradoxical result arose from the marked reduction in feed intake overriding the slight increase in unit price, a phenomenon frequently observed when poorly palatable or anti-nutritional ingredients are included (Alphonsus *et al.*, 2012).

Cost per kg of weight gain was lowest in T₂ with 1.47 kg weight gain (₦1,804.59), which achieved a favourable balance between moderately reduced intake and acceptable growth. In contrast, T₄ produced the most expensive broiler meat (₦3,706.39 kg⁻¹ gain) because severely depressed growth outweighed the savings in feed consumption (Ekpo *et al.*, 2020).

Total Cost of Production and Revenue followed the same pattern as feed cost. However, revenue generated from sales (at a uniform price of ₦3,000 kg⁻¹) reduced as the body weight, ranging from ₦5,280.00 (control) to ₦2,190.00 in T₄.

Gross margin was highest (₦1,757.26) in T₂, despite the highest revenue; T₁ had a lower margin (₦1,697.83) because of its substantially higher feed cost. Gross margin turned negative (-₦515.67) at T₄, rendering that dietary treatment economically unviable under the prevailing market conditions (Ebong *et al.*, 2023).

Conclusion

The results of this study indicate that the inclusion of wild aerial yam (*Dioscorea bulbifera*) meal adversely affected the growth performance and economic returns of broiler chickens as the dietary level increased. However, inclusion at 5% was tolerated with comparatively better performance and profitability than higher inclusion levels. Therefore, poultry farmers and animal nutritionists are advised to limit the use of *Dioscorea bulbifera* meal to a maximum of 5% in broiler diets. Inclusion levels above this

threshold are not recommended due to their negative effects on feed utilisation, growth rate, and economic efficiency. Careful processing and detoxification of the tuber before use are also recommended to minimise the impact of residual anti-nutritional factors and enhance its potential as an alternative feed resource.

CONFLICT OF INTEREST

The authors affirm that no financial, personal, or professional conflicts of interest influenced the conduct or reporting of this study.

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