

(RESEARCH ARTICLE)



Effect of varying levels of processed Black plum *Vitex doniana* supplemented meals on growth performance of broiler chickens

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Abstract

The search for nonconventional feed supplements that can act as growth promoter with cost effectiveness for broiler chickens production and are capable of maximizing its growth performance will create increase supply of protein for the growing populace and growth in the investment of Nigerian poultry farmers. Therefore, a feeding trial was conducted to evaluate the effects of varying levels of processed black plum meal on growth performance of broiler chickens. Two hundred and forty day-old chicks were used for the starter phase and one hundred and eighty four weeks old chicks were used for the finisher phase. *Vitex doniana* leaf meal had significant effects on final weight, weight gain, average daily weight gain, average daily feed intake and feed conversion ratio of broiler starter chicks. Birds fed T2, T3 and T4 diets had similar results in terms of the final weight, weight gain and average daily weight gain compared to chicks fed the control diet. Results showed that broiler finisher chickens fed T2, T3 and T4 diets had similar final weight, weight gain, average daily weight gain, feed conversion ratio and feed cost per kg weight gain. Birds fed the control had the least weight gain. In conclusion, processed black plum meal improved growth performance and reduced cost of feed to gain a kilogramme of meat at both the starter and finisher phases. Therefore, processed black plum meal as supplement in broiler chicken diets will increase efficiency for sustainable broiler chicken production.

Keywords: Black plum; Broiler; Chickens; *Vitex doniana*

1. Introduction

Non-conventional feed stuffs utilization can improve efficiency and cost effectiveness in poultry production. Leaves obtained from browse plants such as African Black Plum (*Vitex doniana*) can be an alternative to address the incessant farmer-herder clashes, continuous increase and fluctuation in the prices of conventional feedstuffs in the tropical savannah region. Frances *et al.* (2013) reported that African Black Plum (*Vitex doniana*) tree and its leaves can serve as a good source of food and fodder for livestock, particularly during off-season in different parts of Nigeria (Makun *et al.*, 2013). In spite of this information on its utilization by ruminants in Nigeria, there is no information on the utilization of *Vitex doniana* processed leaves in poultry feeds and feeding management.

Therefore, knowledge of the utilization of varying levels of *Vitex doniana* supplementation in combination with other feedstuffs to improve the growth performance of broiler starter and finisher chickens is a critical priority to addressing the challenges associated with conventional feed cost in Nigeria. This nutritional challenge necessitates the nutritionist to evaluate the use of *Vitex doniana* processed leaves in improving poultry production at the least costs. The aim of this study therefore, seeks to evaluate the nutritive potential of black plum (*Vitex doniana*) leaves, which is presently of little economic concern in poultry feeding and determine the possibility of including varying levels of *Vitex doniana* leaf meal supplementation to improve the growth performance of broiler chickens.

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2. Materials and methods

2.1. Experimental Site

The experiment was carried out at the Poultry Research Unit of the Department of Agricultural Science Education, Federal College of Education (Technical), Bichi, Kano. The farm is located within the College on the latitude 11° 9' 45" N and longitude 11° 38' 8" E (Samuel *et al.*, 2022).

2.2. Experimental Feed Preparation

The *Vitex doniana* leaves used in this study was collected from *Vitex doniana* trees within and around the mini campus of the Federal College of Education [Technical], Bichi in their raw forms. They were broken into smaller pieces and air-dried sufficiently for a period of two weeks. After air-drying, the required amount of *Vitex doniana* plant as feed supplement source were prepared by fine grinding, passing through 1 mm sieve into smooth powder and stored separately in air-tight containers at the Agricultural Education Department Feed mill and experimental farm. The premixes were sourced from a reputable animal feed ingredients distributor, while other ingredients were sourced from a reputable animal feed resources mill in Kano, Nigeria. Four isonitrogenous and isocaloric diets for the starter and grower phases, respectively were formulated as follows:

- T1 = basal diet with no *Vitex doniana* as feed supplement source
- T2 = basal diet plus 1.0% *Vitex doniana* as feed supplement source
- T3 = basal diet plus 1.5% *Vitex doniana* as feed supplement source
- T4 = basal diet plus 2.0% *Vitex doniana* as feed supplement source

All diets were formulated to meet nutrient requirement standards of broiler starter chicks (NRC, 1994). Tables 2 and 3 present the composition of starter and grower diets containing *Vitex doniana* plant as feed supplement source.

2.3. Design and Management of Experimental Birds

A total of two hundred and forty (240) day-old broiler chicks were used for the study. The birds were assigned in a completely randomized design (CRD) to four dietary treatments and three replicates. All necessary and routine management practices of sanitation, appropriate medication and vaccination were strictly observed. Feed and water were provided *ad libitum*. The birds were weighed at the beginning of the trial and weekly thereafter. Weight gain, feed intake, and feed conversion ratio was calculated. Mortality record was taken as it occurs.

2.4. Statistical Analysis

All data collected in this study were subjected to analysis of variance using SAS (2008), while significant differences between treatment means were separated by Duncan Multiple Range Test at 5% level of significance.

Table 1 Proximate composition of black plum (*Vitex doniana*) leaf

Parameters	%
Moisture	77.03
Crude protein	8.10
Ether extract	2.92
Crude fibre	2.75
Ash	1.63
Carbohydrates	7.57

Source: Adejumo *et al.* (2013).

Table 2 Composition of experimental diets containing levels of processed black plum (*Vitex doniana*) supplemented meals. (0-4weeks)

Ingredients (%)	Treatment Diets			
	T1	T2	T3	T4
Maize	49.57	49.57	49.57	49.57
Groundnut cake	22.50	22.50	22.50	22.50
Soya cake	10.00	10.00	10.00	10.00
Wheat Offal	5.76	5.76	5.76	5.76
Fish meal	4.00	4.00	4.00	4.00
Limestone	0.80	0.80	0.80	0.80
Bone meal	2.90	2.90	2.90	2.90
Common Salt (Nacl)	0.30	0.30	0.30	0.30
Broiler Starter Premix**	0.30	0.30	0.30	0.30
Lysine	0.37	0.37	0.37	0.37
Methionine	0.24	0.24	0.24	0.24
Palm oil	3.50	3.50	3.50	3.50
Black plum (<i>Vitex doniana</i>)	0.00	1.00	1.50	2.00
Total	100.00	100.00	100.00	100.00
Calculated Analysis				
Metabolizable energy (Kcal/kg)	3101	3101	3101	3101
Crude protein (%)	23.0	23.0	23.0	23.0
Ether extract (%)	9.84	9.84	9.84	9.84
Crude fibre (%)	3.25	3.25	3.25	3.25
Calcium (%)	1.33	1.33	1.33	1.33
Lysine (%)	1.27	1.27	1.27	1.27
Methionine (%)	0.65	0.65	0.65	0.65
Available P (%)	0.60	0.60	0.60	0.60

**Biomix premix supplied per kg of diet: Vit. A, 10,000iu; Vit.D₃, 2000 iu; Vit E, 23 mg; Vit. K, 2mg; Vit.B₁,1.8; Vit. B₂, 5.5mg; Niacin, 27.5mg; Pantothenic acid, 7.5mg; Vit. B₁₂, 0.015mg; Folic acid, 0.75mg; Biotin, 0.06mg; Choline chloride, 300mg; Cobalt, 0.2mg; Copper, 3mg; Iodine, 1 mg; Iron, 20 mg; Manganese, 40 mg; Selenium, 0.2 mg; Zinc, 30mg; Antioxidant, 1.25mg.

Table 3 Composition of experimental diets containing levels of processed black plum (*Vitex doniana*) supplemented meals. (5 - 8 weeks).

Ingredients (%)	Treatments Diets			
	T1	T2	T3	T4
Maize	53.05	53.05	53.05	53.05
Groundnut cake	14.00	14.00	14.00	14.00
Soya cake	10.00	10.00	10.00	10.00
Wheat Offal	10.50	10.50	10.50	10.50
Fish meal (72%)	3.00	3.00	3.00	3.00
Limestone	1.50	1.50	1.50	1.50
Bone meal	2.90	2.90	2.90	2.90
Common Salt (Nacl)	0.30	0.30	0.30	0.30
Broiler Finisher Premix**	0.30	0.30	0.30	0.30
Lysine	0.34	0.34	0.34	0.34
Methionine	0.22	0.22	0.22	0.22
Palm oil	4.00	4.00	4.00	4.00
Black plum (<i>Vitex doniana</i>)	0.00	1.00	1.50	2.00
Total	100.00	100.00	100.00	100.00
Calculated Analysis				
Metabolizable energy (Kcal/kg)	3151	3151	3151	3151
Crude protein (%)	21.00	21.00	21.00	21.00
Ether extract (%)	7.79	7.79	7.79	7.79
Crude fibre (%)	3.25	3.25	3.25	3.25
Calcium (%)	1.35	1.35	1.35	1.35
Lysine (%)	1.15	1.15	1.15	1.15
Methionine (%)	0.60	0.60	0.60	0.60
Available P (%)	0.57	0.57	0.57	0.57

**Biomix premix supplied per kg of diet: Vit. A, 10,000iu; Vit.D₃, 2000 iu; Vit E, 23 mg; Vit. K, 2mg; Vit.B₁,1.8; Vit. B₂, 5.5mg; Niacin, 27.5mg; Pantothenic acid, 7.5mg; Vit. B₁₂, 0.015mg; Folic acid, 0.75mg; Biotin, 0.06mg; Choline chloride, 300mg; Cobalt, 0.2mg; Copper, 3mg; Iodine, 1 mg; Iron, 20 mg; Manganese, 40 mg; Selenium, 0.2 mg; Zinc, 30mg; Antioxidant, 1.25mg.

3. Results and Discussion

The performance of broiler starter chicks fed diets containing black plum is shown in Table 4. Dietary treatment had significant effects on final weight, weight gain, average daily weight gain, average daily feed intake and feed conversion ratio. Birds fed T2, T3 and T4 diets had similar results in terms of the final weight, weight gain and average daily weight gain compared to chicks fed the control diet. This result is similar to the findings of Ayo-Ajasa *et al.* (2019) who reported improved performance of broiler chickens fed Moringa oleifera leaf meal when compared with the control. Dietary treatments had significant effect on feed conversion ratio. Feed conversion ratio was significantly better in all fed birds fed *Vitex doniana* leaf meal. However, the increased FCR value observed in birds fed T3 diet might be due to more feed consumed by the birds and thereby growing slowly as evident in the body weight gain observed for birds fed T3 diet. This corroborated the findings of Hascik *et al.* (2010) that a good FCR value is an indication of high quality feed.

Table 4 Growth performance characteristics of broiler chickens fed different levels of black plum (0-4 weeks)

Parameters	Dietary levels of black plum (<i>Vitex doniana</i>) supplements				
	T1	T2	T3	T4	SEM
Initial weight (g/b/d)	40.63	40.57	40.68	40.64	0.08
Final weight (g/b)	1061.88 ^b	1085.17 ^a	1079.17 ^a	1083.33 ^a	24.62
Av. Daily weight gain (g/b/d)	36.09 ^b	36.92 ^a	36.71 ^a	36.92 ^a	24.60
Total feed intake (g/b)	1620.80 ^{ab}	1579.20 ^{ab}	1818.80 ^a	1500.00 ^b	76.73
Daily feed intake (g/b)	57.88 ^{ab}	56.40 ^{ab}	64.96 ^a	53.57 ^b	2.74
Feed conversion ratio	1.60 ^a	1.52 ^a	1.77 ^b	1.45 ^a	0.05
Feed cost/kg gain	203.19	201.26	202.27	203.22	1.85
Mortality (%)	0.00	0.00	0.00	0.00	0.00

^{abc}Means in the same row with different superscript are significantly different. SEM: standard error of mean

The performance of broiler finisher chickens fed diets containing black plum is presented in Table 5. Final weight, weight gain, average daily weight gain, feed conversion ratio and feed cost per kg weight gain were significantly ($p < 0.05$) affected by dietary treatments. Birds fed T2, T3 and T4 diets had similar final weight, weight gain, average daily weight gain, feed conversion ratio and feed cost per kg weight gain. Birds fed the control had the least weight gain. The increase in weight gain observed for broiler chickens fed diet with the highest level of black plum supplementation might be due to the efficient nutrient utilization.

The poor performance with the control diet as observed in this study could be attributed to differences in nutrient digestibility of diets. Dietary treatments had no effect on feed intake. Broiler chickens fed the control diet had the poorest value for feed conversion ratio. This might be due to poor feed consumption resulting in slow growth. Significant linear decrease was observed in feed cost per kg weight gain as the level of black plum increases in the diets. Although, it was observed that broiler chickens fed black plum supplemented diets were statistically similar compared to birds fed the control diet. This implied that the cost of producing one kilogramme of lean meat was minimal for birds fed diets supplemented with black plum meal as compared to those fed the control diet. Dietary treatments had no significant effect on mortality.

Table 5 Growth performance characteristics of broiler chickens fed different levels of black plum *Vitex doniana* (5-8 weeks)

Parameters	Dietary levels of black plum (<i>Vitex doniana</i>) supplements				
	T1	T2	T3	T4	SEM
Initial weight (g/b/d)	1401.83	1402.45	1402.81	1402.02	1.20
Final weight (g/b)	2857.33 ^b	3090.16 ^a	3248.81 ^a	3263.49 ^a	51.49
Av. Daily weight gain (g/b/d)	69.31 ^b	80.37 ^a	87.91 ^a	88.64 ^a	2.44
Total feed intake (g/b)	4012.20	4012.90	4274.80	4212.00	77.75
Daily feed intake (g/b)	191.08	191.90	203.56	200.60	3.70
Feed conversion ratio	2.77 ^b	2.38 ^a	2.32 ^a	2.27 ^a	0.09
Feed cost/kg gain	175.82 ^b	158.61 ^a	159.29 ^a	164.87 ^a	12.49
Mortality (%)	0.00	0.00	0.00	0.00	0.00

^{abc}Means in the same row with different superscript are significantly different. SEM: standard error of mean

4. Conclusion

The study showed that levels of black plum (*Vitex doniana*) supplements in the diets improved growth performance and reduced cost of feed to gain a kilogramme of meat for broiler chickens at both the starter and finisher phases. Therefore, supplementation of black plum as a readily available natural supplement has growth improvement potential in the diets of broiler chickens. This will increase sustainable broiler chickens production efficiency.

Compliance with ethical standards

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Disclosure of conflict of interest

No conflict of interest to be disclosed.

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