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Effect of *Moringa oleifera* Leaf Meal as Replacement for Oxytetracycline on Carcass Characteristics of the Diets of Broiler Chickens

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Authors' contributions

This work was carried out in collaboration between all authors. Authors ADO and EIA designed and carried out the study. Authors IOA and OA managed the literature search. Author IOA wrote the first manuscript and did the statistical analysis. All authors read and approved the final manuscript.

Original Research Article

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ABSTRACT

Aims: The need to seek for a goodoption to the costly oxytetracycline necessitated the reason for conducting this study. Hence, the study was carried out to assess the effect of *Moringa oleifera* leaf meal as a replacement for oxytetracycline on the carcass characteristics of broiler finishers.
Study Design: The design of the study was a completely randomised design.
Place and Duration of Study: The experiment lasted for eight weeks. One hundred and eight one-day-old mixed-sex arbor acres birds were used for the study. The study was carried out at the Poultry Unit of the Teaching and Research Farm, University of Ibadan, Nigeria.
Methodology: Previous studies used different inclusion levels of *Moringa oleifera* leaf meal, while graded levels, different from previously reported levels of inclusion were used in this study. Four dietary treatments were formulated and each treatment had three replicates with nine birds per replicate. The experimental diets contained 250g of oxytetracycline per 100kg of feed for treatment 1 (T1), 200g, 400g and 600g of *Moringa oleifera* leaf meal per 100kg of feed for treatments 2 (T2), 3 (T3) and 4 (T4) respectively. Fresh feeds and clean and cool water were served for the birds *ad libitum* throughout the experimental period. The birds were raised on a deep litter system. At the end of the study,

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two birds were selected from each replicate, and slaughtered by severing the jugular veins with a sharp knife. Weights of various recognised parts and organs were taken and recorded accordingly. Proximate composition of the experimental diets and faecal samples were determined according to the standard method of (A.O.A.C.). Organoleptic test was carried out on the experimental broiler chickens to determine their quality in terms of taste, colour, and tenderness. Samples were prepared from the breast muscle of each replicate. Ten taste judges were used. After each treatment the judges were served cracker biscuit which was used to neutralize their bud before taking another treatment.
Data obtained were subjected to one way of analysis of variance using SAS statistical package, while significant differences among the means were separated using Duncan Multiple range test.
Results: The result revealed that the adding of *Moringa oleifera* leaf meal in the diets of the experimental broiler chickens had no significant effect on the carcass qualities of the birds except for breast, drumstick, spleen and heart. Higher mean values of slaughter weights were however recorded for birds fed diets containing *Moringa oleifera* leaf meal.
Conclusion: It is thus concluded from the results of the study that feeding *Moringa oleifera* at the included levels in this study had no negative influence on the carcass quality but rather improved the breast and drum stick of broiler finishers. Hence, it is recommended as a good feeding ingredient for broiler birds.

Keywords: Antibiotics; broilers; carcass; Moringa oleifera.

1. INTRODUCTION

The use of modern antibiotics as growth promoters, as well as for disease prevention and treatment is becoming unaffordable in developing countries, such as Nigeria [1]. The use of affordable alternative plant materials that possess medicinal properties which can be used to replace the expensive modern antibiotics in developing countries then becomes a necessity. The nutritional and medicinal properties of *Moringa oleifera* leaves suggest it as a good option for the replacement. *Moringa oleifera* is a drought-tolerant tree with high dry matter. *Moringa oleifera* leaf is rich in vitamins (especially vitamin A), amino acids, energy, crude protein, low levels of tannins, trypsin and amylase inhibitors [1,2,3]. It possesses antimicrobial properties, as well as the ability to boost immune system [2,3,4,5,6,7,8]. Several studies involving the use of *Moringa oleifera* in feeding trials with livestock have been documented [9,10,11,12,13,14,15,16,17,18,19]. Although *Moringa oleifera* is native to the Western and sub-Himalayan part of Northwest India, Pakistan and Afghanistan, it is cultivated across Africa (Nigeria, Tanzania, Senegal), [15]. The protein obtained in the press cake of *Moringa oleifera* has been reported to be positively charged and has the potential of being used as an antibiotic [20,21]. The antimicrobial properties of *Moringa oleifera* had earlier been suggested, and the need to seek for a good option to the costly oxytetracycline necessitated the reason for conducting this study. Hence, the study was carried out to determine the effect of replacement of oxytetracycline by *Moringa oleifera* leaf meal on the carcass characteristics of broiler chickens.

2. MATERIALS AND METHODS

2.1 Location of the Study

The study was carried out at the Poultry Unit of the Teaching and Research Farm, University of Ibadan, Nigeria. The location of the study is $7^{\circ}23^{1}$ 47^{1}N and $3^{\circ}55^{1}$ 0'E at altitude 265m

above sea level. The mean total rainfall for Ibadan is 1420.06 mm, falling in approximately 109 days. The mean maximum temperature is 26.46ºC, minimum 21.42ºC and the relative humidity is 74.55% [22]. The birds and feed ingredients used for the study were sourced locally.

2.2 Management of the Experimental Birds

The study lasted for eight weeks. One hundred and eight (108) arbor acres mixed-sex one-day-old chicks were used for the study. Having ascertained that the birds had no deformity or any sign of ailment they were randomly allotted to four experimental treatments with three replicates per treatment. There were nine birds in each replicate. The control diet (T1) contained 250g of oxytetracycline per 100kg of feed, while treatments 2, 3 and 4 contained 200g, 400g and 600g of *Moringa oleifera* leaf meal per 100kg of feed for treatments respectively (Table 1). The birds were served fresh feeds and clean water *ad libitum* throughout the period of the experiment. They were raised on a deep litter system.

2.3 Data Collection and Analysis

Feed intake and weight gain were recorded on daily basis, and at the end of the study, two birds were selected at random from each replicate, and slaughtered by severing the jugular veins with a sharp knife. The birds were bled and immediately dipped in hot water for about 5 minutes to loosen the feathers [23,24]. Weights of various parts and organs were taken and recorded accordingly. Organoleptic test was carried out on the experimental broiler chickens to determine their quality in terms of taste, colour, and tenderness. Samples were prepared from the breast muscle of each replicate. Ten taste judges were used. After each treatment the judges were served cracker biscuit which was used to neutralize their palate before taking another treatment.

Proximate composition of the experimental diets was determined according to the standard method of A.O.A.C. [25]. Data obtained were subjected to one-way analysis of variance using SAS statistical package [26]. Significant differences (*P=.05)* among the means were separated using Duncan Multiple Range Test.

3. RESULTS AND DISCUSSION

Table 1 show the gross composition of the experimental diets. The carcass characteristics of broiler finishers fed graded levels of *Moringa oleifera* leaf meal were shown in Table 2. The result revealed that replacement of oxytetracycline by *Moringa oleifera* leaf meal in the diets of the experimental broilers had no significant effect on the carcass qualities of the birds except for breast, drumstick, spleen and heart. Higher mean values of slaughter weights were recorded for birds fed diets containing *Moringa oleifera* leaf meal.

Birds fed T2 had the highest slaughter weight (2.10 kg/bird), while those on the control diet (T1) had the lowest mean value (1.80kg/bird). Dressed weight had a similar trend. Birds on T3 had the highest mean value for breast (0.38kg/bird) followed by those fed T2 and T4 (0.32kg/bird), while the least mean value was observed for those fed T1 (0.28kg/bird). Birds fed T2 recorded the highest mean value for wing (0.20kg/bird) which was significantly (*P=.05)* higher than the values recorded for those fed other experimental diets. Those on T3 had the highest mean value (11.25%EW) which was not statistically different from the values recorded for other treatments. The result of organoleptic test as shown in Table 3 indicates

that inclusion of *Moringa oleifera leaf* meal did not significantly affect aroma, flavor, and colour for the treatments. Those on T4 had the highest mean value for juiceness (7.20) which was significantly (*P=.05)* higher than those of other treatments.Lowest value was recorded for T3 (3.80). Tenderness followed a similar trend. However, for general acceptance of meat, birds fed T4 recorded the highest value. The mean weight gain ranged between 1066.92g and 1278.00g for finisher phase. Birds fed T4 recorded the lowest weight gain value (1047.33g). There was however no significant difference across the treatments except for the weight of breast and drumstick when compared with eviscerated weight. Birds fed diets containing 0.04% and 0.06% *Moringa oliefera* leaf meal recorded higher weights of breast and drumstick which were significantly (*P=.05)* higher than those of the control diets. Birds fed diets containing *Moringa oleifera leaf* meal had higher feed intake than those fed the control diet. Birds fed diets containing *Moringa oleifera leaf* meal recorded higher values for most of the carcass characteristics measured.

The result of the carcass characteristics in this study is similar to the finding of Nuhu [16] who reported that there were no significant differences among treatments for carcass characteristic for weaner rabbits fed *Moringa oleifera* leaf meal. Ayssiwede et al. [18] also reported earlier that there were no significant difference across treatments except for lung and spleen weights which were significantly increased in birds fed 8% and 16% *Moringa oleifera* leaf meal. The authors reported that inclusion of Moringa leaf meal had no adverse effect on dressing percentage, liver weight, and all organs weight ratios. The finding of the study by Zanu et al. [24] indicated that none of the parameters measured for carcass characteristics in birds fed diets containing *Moringa oleifera* leaf meal was affected significantly by inclusion of moringa leaf meal. The mean values for slaughter weights, heart, thigh, breast, neck, back and drumstick were within the range reported by Asafa et al. [27].

The dressing percentage reported in this study was similar to the value reported by Ologhobo and Adejumo [28]. The slaughter weights recorded in this study were lower than the value recorded by Raach-Moujahed and Hadded [29]. However, carcass yield was slightly higher than the value recorded by Raach-Moujahed and Hadded [29]. The dressed weight in this study is similar to the finding of the study of Iheukwumere et al. [23] who reported that the dressed weight of broilers fed diets containing cassava leaf meal were similar between treatments. It has been noted that the weights of internal organs such as liver can be used in animal feeding as evidence of toxicity of a particular diet [30].

It can thus be inferred from this study that *Moringa oleifera leaf* meal at the level of inclusion posed no threat to the health of broiler chickens. The higher weight gain recorded by birds on T2 and T3 is understandable. Usually, increased feed intake is expected to result in higher weight gain [13]. However, the result of T4 did not follow this expected trend. This disparity could be due to increase crude fiber content in T4. Leaf meals usually contain high fiber content, which consequently increase the fiber content of the diet, thereby diluting other nutrients [13]. It has been noted that animals eat to meet their energy requirement [12]. Hence, this may be the reason for increased feed intake in T4 without corresponding increased weight gain.

Table 1. Gross composition of experimental diets (g/100%DM)

Ingredients	Starter phase				Finisher phase			
	T1	T2	T3	T4	T1	T2	T3	T4
Maize (%)	58.80	58.60	58.50	58.35	65.50	65.80	65.60	65.40
Soya bean meal (%)	25.00	25.00	25.00	25.00	20.00	20.00	20.00	20.00
Groundnut cake (%)	9.25	9.50	9.40	9.25	8.25	8.00	8.00	8.00
Fish meal (%)	3.00	3.00	3.00	3.00	2.00	2.00	2.00	2.00
Dicalcium phosphate (%)	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Limestone(%)	1.20	1.20	1.20	1.20	1.50	1.50	1.50	1.50
Salt (%)	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Premix (%)	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
L-Lysine (%)	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Dl-Methionine (%)	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Oxytetracycline (%)	0.25	-	-	-	0.25	-	-	-
Moringa oleifera (%)	-	0.20	0.40	0.60	-	0.20	0.40	0.60
Calculated nutrients								
Metabolisable energy (Kcal/kg)	3024.00	3029.51	3029.02	3032.09	3064.27	3073.55	3072.27	3070.99
Crude protein (%)	22.49	22.60	22.57	22.50	19.75	21.06	21.50	21.94
Crude fiber (%)	3.29	3.34	3.36	3.39	4.20	3.90	4.00	3.00

Premix: vitamin A (20000000IU), vitamin D (4000000IU), vitamin E (460mg), vitamin K3 (40mg), Vitamin B1 (60mg), vitamin B2 (120mg), Niacin (1000mg), calcium pentothenate (200mg), vitamin B6 (100mg), vitamin B12 (5mg), biotin (1mg), chlorate chloride (8000mg), manganese (2400mg), iron (2000mg), zinc (1600mg), copper (170mg), iodine (30mg), cobalt (6mg), selenium (24mg), antioxidant (2400mg)
T1= 250g of oxytetracycline /100kg of feed; T2= 200g of Moringa oleifera leaf meal /100kg of feed; T3= 400g of Moringa oleifera leaf meal /100kg of feed; T4= 600g of Moringa oleifera leaf meal /100kg of feed

Table 2. Carcass characteristics of broiler finishers fed graded levels of *Moringa oleifera* leaf meal

Parameters	T1	T2	T3	T4	SEM
Mean live weight (kg/bird)	1.80	2.10	2.03	1.90	0.16
Eviscerated weight (kg/bird)	1.56	1.85	1.60	1.47	0.07
Eviscerated weight (%LW)	86.60	88.10	78.80	77.36	7.14
Dressed weight (kg/bird)	1.22	1.51	1.45	1.36	0.08
Carcass yield (% LW)	86.70	71.90	71.43	77.36	3.48
Carcass relative composition					
Head (kg/bird)	0.04	0.05	0.04	0.05	0.01
Head (% EW)	2.50	2.86	2.63	3.06	0.31
Neck (kg/bird)	0.36	0.10	0.07	0.10	0.07
Neck (% EW)	5.77	5.41	4.50	6.53	0.43
Breast (kg/bird)	0.28	0.32	0.38	0.32	0.05
Breast (% EW)	17.95^{b}	17.30^{b}	23.75^{a}	21.92^{a}	0.62
Back (kg/bird)	0.21	0.29	0.25	0.24	0.02
Back (% EW)	13.46	15.68	15.63	16.33	0.80
Thigh (kg/bird)	0.18	0.20	0.19	0.18	0.03
Thigh (% EW)	11.54	10.81	11.85	12.24	0.33
Drumstick (kg/bird)	0.16	0.22	0.21	0.19	0.01
Drumstick (% EW)	10.26^{b}	11.89^{ab}	13.13^{a}	12.24^{a}	0.26
Wing (kg/bird)	0.16^{b}	0.20^{a}	0.18^{ab}	0.16^{b}	0.01
Wing (% EW)	10.26	10.81	11.25	10.88	0.04
Shank (kg/bird)	0.08^{b}	0.10^{a}	0.09^{ab}	0.08^{a}	0.008
Shank (% EW)	5.13	5.41	5.63	5.44	0.31
Lung (kg/bird)	0.01	0.01	0.01	0.01	0.53
Lung (% EW)	0.76^{a}	0.54^{b}	0.63^{ab}	0.68^{ab}	0.03
Liver (kg/bird)	0.04	0.05	0.04	0.04	2.75
Liver (% EW)	2.56	2.70	2.50	2.72	0.09
Spleen (kg/bird)	0.004^{a}	0.0017^{b}	0.003^{ab}	0.0027^{ab}	0.0001
Spleen (% EW)	0.26	0.09	0.19	0.18	0.18
Abdominal fat (kg/bird)	0.02	0.02	0.02	0.02	0.02
Abdominal fat (% EW)	0.96	0.86	1.31	1.43	0.03
Heart (kg/bird)	0.009^{ab}	0.011^{a}	0.008^{ab}	0.007^{b}	0.001
Heart (% EW)	0.58	0.59	0.55	0.48	0.01

Table 3. Organoleptic result of meat of broiler finishers fed graded levels of *Moringa oleifera* leaf meal

Parameters	T1	T2	T3	T4	SEM
Aroma	3.80	4.70	4.00	5.40	0.73
Flavour	6.30	5.80	5.70	6.40	0.72
Colour	3.50	4.20	4.60	5.40	0.53
Juiciness	4.80^{b}	4.60^{b}	3.80^{b}	7.20^{a}	0.48
Tenderness	5.80^{b}	5.70^{b}	4.60^{b}	7.30^{a}	0.51
Overall acceptance	6.20^{ab}	5.50^{b}	5.70^{b}	7.50^{a}	0.49

T1= 250g of oxytetracycline /100kg of feed; T2= 200g of Moringa oleifera leaf meal /100kg of feed; T3= 400g of Moringa oleifera leaf meal /100kg of feed; T4= 600g of Moringa oleifera leaf meal /100kg of feed
Means with different superscripts on the same row are significantly different (P=.05)

4. CONCLUSION

Replacement of oxytetracycline by *Moringa oliefera* leaf meal at the inclusion levels showed improvement in the breast and drum stick when compared with percentage of eviscerated weight. Hence, it is recommended as a good replacement for oxytetracycline for broiler birds, as no negative effects were observed in carcass qualities of the broiler finishers fed the experimental diets.

ETHICAL APPROVAL

Authors declare that "Principles of laboratory animal care" (NIH publication No. 85-23, revised 1985) were followed.

COMPETING INTERESTS

Authors declare that there are no competing interests with respect to the publication of this article.

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