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EFFECT OF *Moringa oleifera* LEAF MEAL AND DIFFERENTLY PROCESSED SEED MEAL AS A REPLACEMENT FOR SYNTHETIC ANTIBIOTICS IN BROILER DIET

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ABSTRACT

The study assessed the effects of raw *Moringa oleifera* leaf meal and raw and cooked *Moringa oleifera* seed meal as a replacement for synthetic antibiotic (tetracycline) on growth performance and haematological parameters. The study lasted for 7 weeks. There were 5 treatments: negative control (D1), positive control (D2), treatments 3, 4 and 5 (D3, D4 and D5) contained 0.25% of raw air-dried M*oringa oleifera* leaf meal, 0.25% raw air-dried and cooked air-dried *Moringa oleifera* seed meal respectively. Each treatment had four replicates of 8 birds per replicate. The results of the study revealed that birds treated with synthetic antibiotics (D2) (1.57kg/bird) and those fed with diet supplemented with raw air-dried *Moringa oleifera* (D4) (1.58 kg/bird) had higher body weight gain compared with those fed negative control (1.45 kg/bird). Feed intake was higher for those fed D2 (2.09 kg/bird), D4 (2.16 kg/bird) and D5 (2.17 kg/bird) than the negative control (1.90 kg/bird). Feed conversion ratio, packed cell volume, white blood cell counts, haemoglobin and red blood cell counts were not significantly different across the treatments, with the exception of urea whose values were lower than the values obtained for the negative control. Raw *Moringa oleifera* seed meal compared well with synthetic antibiotics while inclusion of differently processed *Moringa oleifera* leaf and seed meal did not negatively affect the haematological parameters of broiler finishers.

Key Words: Antibiotic, broilers, herbal alternative, *Moringa oleifera*

INTRODUCTION

The important roles played by poultry industry as food supplier in the world cannot be over-emphasised. Chicken meat represents an important source of animal proteins (Bogosavljevic-Boskovic *et al.*, 2010). Disease outbreak is another important factor mitigating against poultry production and productivity in the Sub-Saharan Africa, aside cost of feed. Outbreaks are accompanied with morbidity, mortality, destruction of the intestinal epithelium which consequently results in reduced body weight gain (BWG), feed conversion ratios (FCR) and reduced egg production thereby resulting in great economic losses (Min *et al.*, 2004; Dalloul and Lillehoj, 2005; Shivaramaiah*et al.*, 2014).

Improved animal husbandry, higher hygiene standards and the use of drugs and vaccination have been adopted as means of controlling disease outbreaks in the flocks in the past. However, the spread of diseases is heightened by the development of resistance to some of the drugs by the causative protozoan parasites and the escalating cost of drugs. Also, consumers now request for poultry products that are free from residual drugs, which is another factor limiting the use of chemotherapeutic agents or antibiotics (Harper and Makatouni, 2002).

Moringa oleifera amidst other wild plants for reasons of cost, accessibility and availability has been exploited in Africa in order to bring solution to numerous health challenges of man. *Moringa oleifera* is believed to contain an antibacterial agent 4(α-L-rhamnosyloxy) benzyl isothiocyanate, which is a plant synthesised derivative of benzyl isothiocyanates (Valarmathy *et al.,* 2010). Anticoccidial property of *Moringa oleifera* extracts had also been reported (Ola-Fadunsin and Ademola, 2014). The anti-nutritional factors present in plant sources such as moringa could be reduced through boiling and other processing techniques (Adejumo and Ologhobo, 2012). The result of the study conducted by Adejumo *et al.* (2016) on liver and heart histology of broiler chickens fed raw *Moringa oleifera* leaf meal and raw and cooked *Moringa oleifera* seed meal as a replacement for synthetic antibiotic indicated that raw *Moringa oleifera* seed meal compared well with the negative control. The aim of this study was to assess the effects of raw *Moringa oleifera* leaf meal and raw and cooked *Moringa oleifera* seed meal as a replacement for synthetic antibiotic (tetracycline) on growth performance, biochemical profile and haematological parameters.

MATERIALS AND METHODS

The study was carried out at the Teaching and Research Farm of Landmark University, Nigeria. Five dietary treatments were formulated: negative control (D1) which contained neither the synthetic antibiotic nor the moringa seed meal, positive control (D2) which contained 0.25% tetracycline administered in water, treatments 3 (D3), 4 (D4) and 5 (D5) contained 0.25% of raw air-dried *Moringa oleifera* leaf meal and 0.25% of raw *Moringa oleifera* and cooked *Moringa oleifera* seed meal respectively. Each treatment had four replicates of 8 birds per replicate. The design of the study was a completely randomised design. Fresh feeds and clean, cool water were supplied to the birds *ad libitum* throughout the period of the study. The study lasted for 7 weeks. Only birds on D2 were given the synthetic antibiotic throughout the period of the study.

Weekly feed intake, body weight gain and feed conversion ratio which were calculated by difference and ratio. Number of mortality was recorded daily. Blood samples were collected from two birds of similar weight to the mean weight of the group from each replicate at the end of the study. The blood samples were collected immediately into EDTA (Ethylene diamine tetra acetic acid) sample bottles according to their various replicates and treatments. Packed cell volume was determined using micro haematocrit, haemoglobin was analyzed using cyanometaemoglobin method given by Mitruka and Rawnsley (1977). White Blood Cell and Red Blood Cell were analyzed according to the improved Neubrauer haemocytometer after appropriate dilution. Another set of blood samples were collected into plain sample bottle for serum profile analysis. Randox commercial kits were used for serum biochemical profile (protein, urea, creatinine, aspartate aminotranseerase (AST) and alanine aminotransferase (ALT). The proximate composition of the experimental diets was carried out using the method of the A. O. A. C. (1996). Gross experimental composition and determined chemical compositions of the experimental diets are presented in Tables 1 and 2 respectively.

Data obtained were analysed within the framework of general linear models of analysis using Statistical Analysis System (SAS, 2003), while significant means were analysed using Duncan's multiple range test of same software.

RESULTS AND DISCUSSION

Growth performance, haematological parameters and serum profile of broiler finishers fed diets supplemented with synthetic antibiotic and raw *Moringa oleifera* leaf meal and raw and cooked *Moringa oleifera* seed meal are shown in Tables 3, 4 and 5 respectively. Birds treated with synthetic antibiotics (D2) (1.57kg/bird) and those fed with diet supplemented with raw air-dried *Moringa oleifera* (D4) (1.58 kg/bird) had significantly (P=0.05) higher body weight gain compared with those fed negative control (1.45 kg/bird). Body weight gain of birds in D5 (1.51 kg/bird) and D3 (1.45 kg/bird) was statistically similar to those of negative control (1.45 kg/bird). Feed intake was higher for those fed D2 (2.09 kg/bird), D4 (2.16 kg/bird) and D5 (2.17 kg/bird) than the negative control (1.90 kg/bird). Feed intake by birds on D3 (raw moringa leaf meal) (2.01 kg/bird) was statistically similar to that of negative control (1.90 kg/bird). Feed conversion ratio, packed cell volume, white blood cell counts, haemoglobin, red blood cell counts and serum profile of the experimental birds were not significantly different across the treatments, except for urea. Birds on D2 obtained the least value of urea (1.40 mmol/l) which was significantly (P=0.05) lower than the value obtained for those on D1 (3.42 mmol/l).

The result obtained from this study showed that birds fed with raw *Moringa oleifera* seed meal compared well with the ones on positive control diet (D2). This may be attributed to the essential nutrients contained in moringa seed meal. It could be said that the raw moringa seed meal contain some bioactive substances which have not been destroyed by heat as it could have been the case with the cooked one (D5). Juniar *et al.* (2008) earlier reported that the inclusion of *Moringa oleifera* leaf meal at amounts up to 10% in broiler diets did not produce significant effects on body weight, feed conversion ratio, carcass weight, production efficiency factor and income over feed cost. Haematological characteristics of livestock could be used to assess the effect of nutrition they are fed with (Madubuike *et al.,* 2006). Inclusion of moringa seed meal in the diets of the birds did not yield any significant difference in PCV, WBC, RBC, and Hb. This is in agreement with the work of Ola- Davies *et al*. (2014) who reported that the aqueous extract of the seed *M. oleifera* fed to rats did not induce any toxic effect in wistar rats.

The results of the present study are also in agreement with the findings of Annongu *et al.* (2013) who reported that moringa seed meal fed to broiler birds did not have any adverse effect on the animals. Also, Ewuola *et al.* (2012) earlier reported no significant difference across the treatments for growing rabbits fed graded levels of *Moringa oleifera* leaf meal. The result obtained in the present study is an indication that the dietary treatments were nutritionally adequate for the birds. The non-significant effect of the White blood cell (WBC) counts in the present study may further confirm that the experimental diets neither impaired nor enhanced the bird ability to ward off infection (Olugbemi *et al.,* 2010).

Serum biochemical parameters may give relevant information for the evaluation of the health status of birds and show many metabolic alterations of organs and tissues when feeding unconventional feed sources (Kudair and Al-Hussary, 2010). The non-significance of AST and ALT in the present study may be an indication that the treatments had no untoward effect on the health status of broilers. The non -significance of AST and ALT agrees with Ewuola *et al*. (2011) who observed that the serum enzyme activities of gestating and lactating rabbits administered crude moringa extract were not significantly different from the control rabbits. This therefore suggests that the test ingredients did not result in organ toxicity. The significant decreases in urea at 0.25% of synthetic antibiotic and 0.25kg of raw moringa (*Moringa oleifera*) seeds could be an indication that there was poor dietary protein utilisation and ailing effect on the organs of the birds. Aside from urea all other indices measured where

not significantly different across the treatments. Since liver is reported to contain enzymes like ALT and AST, it releases these enzymes to the blood when damaged (Kaplan *et al.*, 2003). Hence, the absence of significant differences among treatment diets in serum AST and ALT in the present study may reflect normal liver function of the birds fed diets containing moringa seed meal. Olugbemi *et al.* (2010) earlier reported that *Moringa oleifera* leaves have a beneficial effect on the immune responses and improve intestinal health of broilers. Urea is one of the non-protein nitrogenous substances that accumulate in the plasma when renal excretion is reduced. Causes of increased blood urea levels include: high protein diet, intestinal haemorrhage, dehydration, severe haemorrhage, shock, etc. The decrease in the level of urea in the treatments could suggest that there was no adverse effect on some of the organs in the body of the birds. The result of the study conducted by Adejumo *et al.* (2016) on liver and heart histology of broiler chickens fed raw *Moringa oleifera* leaf meal and raw and cooked *Moringa oleifera* seed meal as a replacement for synthetic antibiotic indicated that raw *Moringa oleifera* seed meal compared well with the negative control.

Table 1. Composition and nutrient content of experimental diet fed to broiler chickens

Ingredients (%)	Starter	Finisher
Maize	54.00	66.00
Soya bean	31.00	20.00
Fish meal (72% CP)	3.00	2.00
Palm oil	1.50	0.00
Wheat offal	6.00	8.00
Bone meal	2.00	2.00
Oyster shell	1.00	1.00
Salt	0.25	0.25
Methionine	0.25	0.25
Lysine	0.25	0.25
Premix	0.25	0.25

ME= metabolisable energy; Premix contains: vit A (10000000IU); vit D3 (3000000IU); vit E (30000IU); vit K (2300mg); vit B2 (5000mg); vit C (2000mg); niacin (30000mg); panthotenic acid (8000mg); vit B6 (3000mg); vit B12 (16mg); folic acid (800mg); biotin (600mg); choline chloride (200000mg); cobalt (200mg); copper (600mg); iodine (25000mg); iron (20000mg); manganese (85000mg); selenium (120mg); zinc (50000mg); antioxidant (1250mg). D1 = negative control, D2 = 0.25g of synthetic antibiotics (oxytetracycline)/kg feed, D3 = 0.25g of raw *Moringa oleifera* leaf meal/kg feed, D4 = 0.25g of raw *Moringa oleifera* seed meal/kg feed, D5 = 0.25g of cooked *Moringa oleifera* seed meal/kg feed

Table 2. Determined chemical composition of experimental diets (finisher phase)

Nutrients (%)	D1	D2	D3	D4	D5
Moisture	10.56	10.59	10.75	10.76	10.70
Crude protein	19.66	18.35	18.80	18.88	18.73
Crude fibre	2.50	2.37	2.44	2.36	2.44
Fat	5.54	4.88	5.47	5.46	5.70
Ash	10.69	8.92	10.26	10.01	10.34
Calcium	0.62	0.38	0.66	0.68	0.65
Phosphorus	0.78	0.74	0.75	0.75	0.76
Starch	37.21	39.28	37.89	37.93	38.00
Total sugar	3.42	3.57	3.45	3.44	3.54

D1 = negative control, D2 = 0.25g of synthetic antibiotics (oxytetracycline)/kg feed, D3 = 0.25g of raw *Moringa oleifera* leaf meal/kg feed, D4 = 0.25g of raw *Moringa oleifera* seed meal/kg feed, D5 = 0.25g of cooked *Moringa oleifera* seed meal/kg feed

Table 3. Performance characteristics of broiler finishers fed synthetic antibiotics and differently processed *Moringa oleifera* leaf and seed meal

Parameters	D1	D2	D3	D4	D5	SEM
Initial weight (kg)	0.13	0.15	0.14	0.14	0.13	0.01
Feed intake (kg/bird)	1.90^{c}	2.09^{ab}	2.01^{bc}	2.16^{a}	2.17^{a}	0.03
Final weight (kg)	1.58^{b}	1.72^{a}	1.59^{b}	1.70^{a}	1.64^{b}	0.02
Weight gain (kg)	1.45^{b}	1.57^{a}	1.45^{b}	1.58^{a}	1.51^{ab}	0.02
Feed Conversion Ratio	1.32	1.33	1.39	1.37	1.44	0.02
Mortality	0.00	0.00	0.00	0.00	0.00	0.00

Means with different superscript on the same row are significantly different, *p*= 0.05 SEM= standard error of mean, D1 = negative control, D2 = 0.25g of synthetic antibiotics (oxytetracycline)/kg feed, D3 = 0.25g of raw *Moringa oleifera* leaf meal/kg feed, D4 = 0.25g of raw *Moringa oleifera* seed meal/kg feed, D5 = 0.25g of cooked *Moringa oleifera* seed meal/kg feed

Table 4. Haematological parameter of broiler chickens fed synthetic antibiotics, *Moringa oleifera* leaf and differently processed *Moringa oleifera* seed meal

Parameters	D1	D2	D3	D4	D5	SEM
Packed cell volume (%)	28.33	34.33	28.00	39.33	39.00	2.61
White blood cell ($x10^3$/L)	15.67	16.27	15.93	20.27	13.13	0.86
Haemoglobin (g/L)	9.38	11.69	9.30	12.95	13.42	0.84
Red blood cell (x 10^6/L)	4.84	5.89	5.02	6.65	6.65	0.27

Means with different superscript on the same row are significantly different, *p*= 0.05 SEM= standard error of mean, D1 = negative control, D2 = 0.25g of synthetic antibiotics (oxytetracycline)/kg feed, D3 = 0.25g of raw *Moringa oleifera* leaf meal/kg feed, D4 = 0.25g of raw *Moringa oleifera* seed meal/kg feed, D5 = 0.25g of cooked *Moringa oleifera* seed meal/kg feed

Table 5. Serum profile of broiler finishers fed synthetic antibiotics and differently processed *Moringa oleifera* leaf and seed meal

Parameters	D1	D2	D3	D4	D5	SEM
ALT (µmol)	55.0	31.7	54.60	27.00	28.50	5.68
AST (µmol)	103.17	74.67	76.80	97.83	78.40	15.68
Urea (mmol/l)	3.42^{a}	1.40^{c}	2.19^{b}	1.52^{c}	1.89^{b}	0.41

ALT= alanine aminotransferase, AST= aspartate aminotransferase, Means with different superscript on the same row are significantly different, *p*= 0.05 SEM= standard error of mean, D1 = negative control, D2 = 0.25g of synthetic antibiotics (oxytetracycline)/kg feed, D3 = 0.25g of raw *Moringa oleifera* leaf meal/kg feed, D4 = 0.25g of raw *Moringa oleifera* seed meal/kg feed, D5 = 0.25g of cooked *Moringa oleifera* seed meal/kg feed

CONCLUSION

Results from the present study revealed that raw *Moringa oleifera* seed meal compared well with the control diets at 0.25% inclusion level as a replacement for synthetic antibiotic.

Hence, it can be concluded that raw *Moringa oleifera* seed meal may possess antibacterial properties that could make it a potential replacement for synthetic antibiotics without serious adverse effect on the performance of the animals. However, we recommend further studies at higher level of inclusion with challenged animals. The study has formed a basis for further studies to solve the anti-bacterial resistance against livestock diseases.

DECLARATION OF CONFLICT OF INTEREST

Authors declare that no conflict of interest exist with the manuscript.

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