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EFFECT OF AQUEOUS *Moringa olefeira* (Lam) LEAF EXTRACTS ON GROWTH PERFORMANCE AND CARCASS CHARACTERISTICS OF BROILER CHICKEN

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Abstract

Two hundred and forty (240) day old Hubbard broiler chicks were used to investigate the effect of aqueous Moringa oleifera leaf extracts (AMOLE) on growth performance and carcass characteristics of broiler chickens. The birds were stabilized for one week before they were randomly allocated into six treatments with four replicates, and each replicate containing 10 broiler chicks, making a total of 40 birds per treatment. The completely randomized experimental design (CRD) model was used. The treatments contained $AMOLE_{0+}$ (positive control with antibiotic treatment), $AMOLE_{0-}$ (negative control with ordinary water), $AMOLE_{60}$ (60 ml), $AMOLE_{90}$ (90 ml), $AMOLE_{120}$ (120 ml) and $AMOLE_{150}$ (150 ml) indicating the inclusion levels of aqueous Moringa oleifera leaf extracts respectively. The experiment lasted for 42 days. Results show that AMOLE treatments significantly ($P<0.05$) influenced the final body weight, feed intake, water intake, growth rate, feed conversion ratio and dressing percentage, as well as weight of the large intestine and lungs. Birds on positive control had the highest final body weight and growth rate (2392.00 g and 53.61 g respectively) while birds on 150 ml/l of AMOLE had the least (2042.00 g and 45.37 g respectively). Birds on positive control had the highest (84.70 g) feed intakke and birds on 90 ml/litre of AMOLE had the lowest (73.19 g); while the results of feed conversion ratio (FCR) indicate that birds on $AMOLE_{90}$ (90 ml) and $AMOLE_{120}$ (120 ml) performed better than the positive control treatment. Birds on the AMOLE treatments had similar dressing percentages though that of positive control was highest (94.93 %); while those on $AMOLE_{60}$ and $AMOLE_{150}$ had the highest large intestine and lung weights respectively. It could, therefore, be concluded that up to 120 ml of aqueous Moringa oleifera leaf extract can be included in the diet of broiler chicken for improved feed conversion efficiency and as a cheap source of plant growth promoter in broiler chicken production.

Key words: *Moringa leaf extracts, growth performance, carcass characteristics, broiler chicken.*

Introduction

Poultry production remains the most wide spread of all livestock enterprises; it constitutes an important pillar of food security improvement as well as socio-cultural and economic development in most countries (Alders, 2005; Dieye *et al.*, 2010). Broiler production is a source of income that attracts many people since it offers a good source of protein. Also, it is a promising source of additional income and quick returns (Kekocha, 1994). However, the industry in the developing countries is facing some challenges; which include high feed to gain ratio and increase in the cost of feed because of high prices of feed ingredients (Abbas, 2013). Numerous attempts have been made to overcome these challenges, and one of them involves the use of antibiotics in feed. Antibiotics have been utilized as growth promoters and to prevent outbreak of diseases (Thomke and Elwinger, 1998; Phillips *et al.*, 2004). Furthermore, medication in water using antibiotics helps birds to recover from diseases (Khalafalla *et al.*, 2010). However, the benefit of the use of antibiotics as growth promoters is limited because of problems associated with antibiotics such as drugs toxicity, residual effects and development of bacteria resistance (Ogbe and John, 2012). This problem has led to the ban on the use of antibiotics as growth promoters by the European Union (Butaye *et al.*, 2000; Catalá-Gregori *et al.*, 2008). Thus, attention to safe and natural alternatives such as plants (phytobiotics) to replace antibiotics is on the increase.

One of such plants is *Moringa oleifera. Which* has been studied for many years for its numerous health benefits to man and is now being investigated for its fast growth, higher nutritional value and utilization as a livestock fodder crop (Nouman *et al.*, 2013). Incorporation of this herb and its products in livestock feeds and water to stimulate the effective use of feed nutrients may result in more rapid weight gain, higher production and better feed efficiency. This is because it contains active substances that can improve digestion and metabolism and possess bacterial and immuno stimulant activities (Ghazalah and Ali, 2008). Although there are several studies on the use of *Moringa oleifera,* there are however scanty reports

on the use of aqueous *Moringa oleifera* leaf extracts in drinking water to improve growth performance of broilers in Nigeria.

Materials and Methods

Study location

This study was carried out at the Animal Production Teaching and Research Farm of the Federal University of Technology, Minna, Niger State in Nigeria. Minna is located between latitude 9°37′ North and longitude 6°33′ East. It is located in the Southern Guinea Savanna vegetation zone of North Central Nigeria. The mean monthly minimum and maximum temperatures are 38°C and 42°C respectively. The mean annual rainfall is between 1200 mm – 1300 mm while the mean monthly relative humidity is 65 % (Niger State Agricultural Development Project, 2009).

Source of the test ingredients and preparation of the extracts

Fresh *Moringa oleifera* leaves were purchased between May and June from farmers in Minna. The leaves were air-dried for five days and ground into fine particles using a simple hammer mill. 60 g of the ground particles were then soaked in one litre of water for 24 hours, and this was done daily. The preparation were then filtered using a muslin cloth to separate the debris from the filtrate, and the extracts were placed in clean containers and diluted using borehole water (volume/volume) to form 0, 60, 90, 120 and 150 ml/1000 ml water for Treatments 2 to 5, respectively. This procedure was carried out daily and the filtrate served to the experimental birds in their drinking water.

Source of the experimental birds, experimental diets and experimental design

A total number of 240 day old Hubbard broiler chicks were purchased from Bnot Harel Hatchery, Oluyole Extension, Ring Road, Ibadan, Oyo State in Nigeria. The birds were randomly allocated to six treatments of aqueous *Moringa oleifera* leaf extracts (AMOLE) in a completely randomized design experimental model. Each of the treatments had four replicates with ten birds per replicate. The birds were acclimatized for one week before being given the experimental treatments. Treatment 1 was the Control of which antibiotics (GENDOX®) at 1.25g/litre was used; Treatment 2, 3, 4, 5 and 6 were given 0, 60, 90, 120 and 150 ml per litre of aqueous *Moringa oleifera* leaf extracts (AMOLE) respectively (Table 1).

Management of the experimental birds

Twenty four (24) pen units, with an area of a square metre each that could accommodate ten broilers were constructed. The walls and floors of the pens were disinfected with Germicide (IZAL®) after washing with detergent and water. Old newspapers spread on wood shavings as litter materials were used for the first one week of the chicks' life. Clean and disinfected feeders and drinkers were set in a place accessible to the birds. Each pen unit was properly labelled for easy identification of each treatment group. In addition, a traditional charcoal pot was placed at a strategic area of each pen unit. The distance of the charcoal pot was adjusted based

Table 1: Aqueous *Moringa oleifera* leaf extracts treatment levels

Treatment	Level of inclusion
$AMOLE_{0+}$	Antibiotic (1.25 g/litre)
$AMOLE_{0-}$	0 ml/l
$AMOLE_{60}$	60 ml/l
$AMOLE_{90}$	90 ml/l
$AMOLE_{120}$	120 ml/l
$AMOLE_{150}$	150 ml/l

ml/l = Millilitre per litre
AMOLE = Aqueous *Moringa olefeira* leaf extracts

Table 2: Proximate composition of *Moringa oleifera* leaf meal

Parameters	Percentage composition (%)
Dry matter	94.25
Ether extract	5.50
Crude protein	23.80
Crude fibre	16.57
Ash	9.75
Nitrogen free extracts	38.63

on the response of chicks to weather condition and rate of feather growth. The charcoal pot was removed during the third week when feathers were fully grown. Super starter mash from TOP FEED® containing a crude protein (CP) content of 26.60 % and metabolizable energy (ME) of 2985 kcal/kg were given to the birds during the first two weeks, and starter mash (containing 24.85 % CP and 3013 kcal/kg ME) during the third and fourth week. Finisher feed pellets containing 22.05 % CP and 3026 kcal/kg ME were given during the fifth week of age till the sixth week. Feeds were given *ad libitum* and shifting from one form of feeds to another was done gradually to avoid digestive disorder. Medications and proper vaccinations were given to the birds based on the recommendations of the Nigerian Veterinary Medical Association (NVMA) for this region.

Data Collection

Average daily feed intake was obtained by subtracting the quantity of the left-over (uneaten) feed from the quantity of feed supplied to the birds per day. Weekly body weight gain was determined by subtracting the body weight of the birds the preceding week from the body weight of the birds the following week. Feed conversion ratio (FCR) was obtained by dividing the average feed intake per bird per week by the body weight gained per bird per week for each treatment. Water intakes were determined by calculating the difference between the left over and the initial quantity of water given.

For carcass analysis, two birds per replicate were randomly selected, at the end of the experiment, and fasted for 18 hours. Live body weight were recorded prior to slaughter. After evisceration, the data on hot carcass weights and organ weights were recorded and expressed as a percentage of the live body weights. The eviscerated carcass were chilled at 1- 4 ^{0}C for 24 hours. Then cold carcass weights were determined. The carcasses were partitioned and the breast, wing, thigh, drumsticks and feet yields were weighed and expressed as percentage of the cold carcass weight according to the procedure of Hassan *et al.* (2004).

Chemical analysis

Proximate composition of *Moringa oleifera* leaf meal and the phytochemical composition of the leaf meal and the aqueous leaf extract were determined using the procedures of AOAC (2006).

Statistical analysis

Data collected were subjected to one way analysis of variance (ANOVA) based on the Completely Randomized Design model, using Statistical Analysis System (SAS, 2012). Where differences occurred at 5 % ($P<0.05$), they were separated using Duncan's Multiple Range Test (SAS, 2012).

Results and Discussion

The results of the proximate composition of *Moringa oleifera* leaf is presented in Table 2. Results obtained in this study show that *Moringa oleifera* leaf meal has high crude protein content (23.80 %). This is similar to the result of Nuhu (2010) who reported values of crude protein, ether extract, crude fibre, ash and nitrogen free extracts to be 29.55, 22.30, 19.50 and 7.13 % respectively. It is also similar to the results of Oduro *et al.* (2008) who reported that *Moringa oleifera* leaf meal contains 27.51 % CP, 19.25 % CF, 22.3 % EE, 7.13 % ash and 76.53 % dry matter. Furthermore, crude protein results of 23.80 % obtained in this study is within the 20 to 33 % reported by Foidl and Paull (2008). However minor differences in the compositions could be due to environmental factors which play a minor role in determining the nutritive value of *Moringa oleifera* leaf meal.

Birds on the $AMOLE_{0+}$ treatment had the highest final body weight (FBW) and daily body weight gain (DBWG). Furthermore, the FBW and DBWG of birds on the aqueous *Moringa oleifera* leaf treatments increased until 120 ml and then declined; this implies that the optimal dosage must have been reached at about 120 ml before it declined. This result is similar to the report of Zanu *et al.* (2012) who observed that the FBW and DBWG increased with increase in dosage level until 10 % and then significantly declined with increasing level of *Moringa oleifera* leaf meal. Unlike the results from previous researchers (Ashong and Brown, 2011; Portugaliza and Fernandez, 2012; John and Kenaleone, 2014), birds on the AMOLE treatments had significantly ($P<0.05$) lower FBW than the control. This might be because they used the leaf meal in their studies instead of the aqueous extracts used in this study.

On the feed intake results, birds on the control treatment had the highest value (84.70 g/day), which is an indication that AMOLE inclusion depressed feed intake. This finding is similar to those of Ashong and Brown (2011) who reported that the control group had higher feed intake compared to the treatment groups. The decrease in feed intake in birds on the AMOLE treatments is also in line with those of Portugaliza and Fernandez (2012) who observed that *Moringa oleifera* aqueous leaf extracts in drinking water significantly decreased feed intake of broilers as the concentration given increased. This could be as a result of improved digestion and metabolism activities of *Moringa oleifera* (Ghazalah and Ali, 2008), thus, meeting the nutrients requirements at lower feed intake.

The results of the FCR indicate that the birds on the

Table 3: Phytochemical composition of *Moringa oleifera* leaf meal and aqueous leaf extracts

Parameter	Moringa Preparations	
	Moringa oleifera leaf meal	Aqueous *Moringa oleifera* leaf extracts
Total flavonoids (µg/ml)	0.11	0.11
Total phenols (µg/ml)	9.97	10.78
Alkaloids (mg/ml)	0.26	0.21
Tannins (µg/ml)	1.17	5.33
Saponins (µg/ml)	245.3	22.55

Table 4: Growth performance of broiler chicken administered different levels of aqueous *Moringa oleifera* leaf extracts in their drinking water

Parameter	$AMOLE_{0+}$ (Control)	$AMOLE_{0-}$	$AMOLE_{60}$	$AMOLE_{90}$	$AMOLE_{120}$	$AMOLE_{150}$	SEM
Initial body weight (g)	140.00	138.75	138.75	136.25	141.25	136.25	1.58
Final body weight (g)	2392.00^{a}	2350.00^{c}	2200.00^{e}	2242.00^{d}	2367.00^{b}	2042.00^{f}	25.29
Daily body weight gain (g)	53.61^{a}	52.65^{c}	49.08^{e}	50.13^{d}	52.99^{b}	45.37^{f}	0.60
Daily feed intake (g)	84.70^{a}	76.34^{bc}	78.53^{b}	73.19^{c}	79.49^{b}	76.68^{bc}	3.58
FCR	1.58^{b}	1.45^{a}	1.60^{bc}	1.46^{a}	1.50^{ab}	1.69^{c}	0.03
Daily water intake (ml)	516.08^{a}	509.07^{a}	430.89^{b}	498.04^{ab}	490.39^{ab}	492.29^{ab}	11.63

^{abcdef} Means in the same row with different superscripts were significantly different ($P<0.05$)
SEM = Standard error of means $AMOLE_{0+}$ = Positive control (with antibiotic)
FCR = Feed conversion ratio $AMOLE_{0-}$ = Negative control (with ordinary water)

Table 5: Effect of aqueous *Moringa oleifera* leaf extracts on carcass characteristics and carcass cut - up parts of broilers chickens

Parameter	Treatment						SEM
	$AMOLE_{0+}$ (Control)	$AMOLE_{0-}$	$AMOLE_{60}$	$AMOLE_{90}$	$AMOLE_{120}$	$AMOLE_{150}$	
Live weight (g)	2450.00	2525.00	2250.00	2275.00	2425.00	2300.00	46.66
Hot carcass weight (g)	2325.00	2390.00	2100.00	2075.00	2100.00	2100.00	50.19
Dressing %	94.93^{a}	94.67^{a}	93.33^{ab}	91.23^{ab}	89.69^{b}	91.26^{ab}	0.71
Wings (%)	10.22	10.89	10.03	9.88	10.32	9.76	0.27
Breast (%)	23.55	23.95	23.32	24.17	23.72	23.89	0.43
Thighs (%)	14.23	14.88	14.42	12.40	13.38	11.94	0.44
Drumsticks (%)	11.20	11.80	12.20	10.99	12.40	11.94	0.26

AMOLE = Aqueous *Moringa oleifera* leaf extracts
SEM = Standard error of means

AMOLE treatments at an inclusion of 90ml and 120ml/l (1.46 and 1.50 respectively) performed better than the control (1.58). This implies that the AMOLE treatments at these levels can be used to replace the antibiotic growth promoter. This might be because of the presence of bioceutical agents in *Moringa oleifera* plant as reported by Lannaon (2007) and bacterial and immuno stimulant activities of *Moringa oleifera* plant (Ghazalah and Ali, 2008). Furthermore, the $AMOLE_{90}$ and $AMOLE_{120}$ birds gave better FCR than the control, which means better returns on investment. This assertion is supported by David *et al.* (2012), Ebenebe *et al.* (2012) and El-Tazi (2014) who reported better feed conversion ratio for birds on *M. Oleifera* diets as compared to the control diets. There was a significant ($P<0.05$) effect of aqueous *Moringa oleifera* leaf extracts on the dressing percentage of broiler chicken. Thist is in line with the results of Aderinola *et al.* (2013) who studied the effect of *Moringa oleifera* leaf meal on broiler chicken. El-Tazi (2014) also reported influence of

Table 6: Effect of aqueous *Moringa oleifera* leaf extracts on the visceral organs (%) of broiler chicken

Parameter	Treatment						SEM
	$AMOLE_{0+}$ (Control)	$AMOLE_{0-}$	$AMOLE_{60}$	$AMOLE_{90}$	$AMOLE_{120}$	$AMOLE_{150}$	
GIT	7.10	7.37	6.98	7.75	8.13	7.73	0.22
Proventiculus	0.31	0.25	0.31	0.25	0.26	0.30	0.01
Crop	9.00	7.82	9.65	5.30	7.65	5.25	0.64
Gizzard	1.91	1.83	2.34	2.02	1.98	2.25	0.22
Small intestine	1.65	1.62	1.89	1.66	2.20	1.47	0.10
Caecum	9.95	6.60	7.65	9.10	10.70	11.75	0.75
Large intestine	0.14^{b}	0.11^{b}	0.23^{a}	0.14^{b}	0.89^{b}	0.15^{b}	0.01
Heart	0.38	0.32	0.37	0.39	0.40	0.37	0.01
Liver	1.19	1.38	1.26	1.43	1.39	1.33	0.05
Kidney	0.23	0.16	0.27	0.33	0.11	0.22	0.03
Lung	0.24^{b}	0.24^{b}	0.29^{ab}	0.23^{b}	0.24^{b}	0.31^{a}	0.01
Spleen	0.05	0.07	0.14	0.10	0.08	0.09	0.01
Fat	1.46	1.88	1.77	0.98	1.37	0.97	0.13

SEM = Standard error of means
AMOLE = Aqueous *Moringa oleifera* leaf extracts
GIT = Gastrointestinal tract

Moringa oleifera treatments on rabbit. However, Ayssiwede *et al.* (2011) and Ochi *et al.* (2015) who studied the effect of *Moringa oleifera* seed powder on broiler chickens did not observe significant differences in the dressing percentage among the treatments. The variation could be attributed to the difference in the supplementation form of *Moringa oleifera* leaf meal. Inclusion of aqueous *Moringa oleifera* leaf extract showed no significant ($P>0.05$) influence on the weight of the breast meat, thighs, wings and drumsticks. This is in line with the results of Ayssiwede *et al.* (2011). There were significant differences ($P>0.05$) in the weight of the large intestine and lungs. The reason for this is not known as AMOLE treatments had no influence on the weight of the other organs in the broiler birds. Similar results were reported by Zanu *et al.* (2012) and Aderinola *et al.* (2013).

Conclusion

Aqueous *Moringa oleifera* leaf extract can be included up to 120 ml/litre in the diet of broiler chicken for improved feed conversion efficiency serving as a cheap source of plant growth promoter in broiler chicken production.

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