EFFECTS OF MORINGA LEAF EXTRACT ON GROWTH PERFORMANCE AND CARCASS CHARACTERISTICS OF BROILER CHICKENS

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ABSTRACT

A total of ninety-six (96) day-old broiler chicks were used to evaluate the growth performance and carcass characteristics of broiler chickens raised under the same environmental condition. The experiment was carried out at the University of Abuja Teaching and Research Farm. The birds were divided into four treatments, three replicate per treatment in a completely randomize design (CRD). The experiment lasted for 56days, the birds were fed on two basal diet (starter and finisher throughout the experimental period). The moringa leaf extract was added to their water at 0.00 (T_1), 20 (T_2), 40 (T_3) and 60ml (T_4) per liter respectively. Data were collected on weekly growth performance and carcass characteristics were recorded. At the end of the experiment, the birds were slaughtered and eviscerated. The prime cuts and organs were weighed to estimate the different parameters. Data collected were analyzed for Analysis of Variance (ANOVA) using SPSS. The results showed that there was no significant ($P>0.05$) difference in all the parameters examined (head, neck, wings, liver, breast, gizzard, drumstick, thigh, heart and shank) except back cut which was significantly ($P<0.05$) different across the treatments. However, the oral supplementation of moringa leaf extract has no significant ($P>0.05$) effect on the weekly growth performance of broiler chickens except in week four which was significantly ($P>0.05$) different. Phytochemical analysis revealed the presence of phenols (15.93 %), flavonoids (10.21 %), terpenloids (5.07 %), steroids (2.83 %), tannins (9.84 %), saponins (4.03 %), alkaloids (2.44 %) and oxalates (0.74 %) respectively. The study concluded that oral supplementation of moringa leaf extract had no deleterious effect on the carcass characteristics and weekly growth performance of broiler chicks.

Keywords: *Antibiotics, Broiler, Growth, Moringa, Phytochemicals*

INTRODUCTION

In many developing countries of the world including Nigeria, the broiler industry plays a major role in supplying the population with meat which is highly nutritious and popularly consumed (Ukwu, 2004). The broiler chicken in Nigeria had served as the major source of protein for the population. Growth in broilers is a very complex phenomenon which is influenced by genotype as well as by environmental factors, including nutrition. Genotype plays a major role in carcass fatness and the quality of meat (Musa *etal*., 2006). Therefore, as the genetic potential and the characteristics of poultry have evolved, so has the manipulation of diet specifications to suit market needs and meet the nutrient requirements of birds, for purposes of optimizing immune responsiveness, rather than simply growth rate or classical feed efficiency. Developments in poultry nutrition have generally been driven by the need to sustain

genetic potential within the confines of ever evolving systems of poultry production (Leeson, 2008). Owing to genetic selection, the modern broiler has lower feed intake per unit of body weight (BW) gain, with the potential to increase recognition of white meat in comparison to commercial broilers of the past (Dozier *et al*., 2008). Consequently, over the last fifty years nutritionists have developed quite sophisticated systems for quantifying the available nutrients in both ingredients and diets, thus providing birds with precise levels of nutrients required for production (Leeson, 2008).

Additives in poultry diets are primarily included to improve efficiency of the bird's growth, prevent diseases and improve feed utilization. This leads to improved production, such as meat quality. For an example, antimicrobials which are common feed additive used in poultry diets have been used extensively in intensive poultry operations in order to minimize diseases, and improve growth and feed utilization.

The prophylactic use of antibiotics (as growth promoters) in animal feeds has made intensive farming possible and improved feed conversion in these animals (Herna'ndez *etal*., 2004). Until recently, gain in protein deposition (based on an improved feed conversion rate enhanced by antibiotic usage) has facilitated improvements in production efficiency, thereby allowing the consumer to purchase (at a reasonable cost) high quality meat and eggs.

Antibiotic growth promoters in the poultry industry have been banned because of harmful effects on human health. This was observed by the development of microbial resistance to these products (McCartney, 2002). Several alternatives to these growth promoters have been proposed and organic acids, medicinal plants as natural feed additives are now recently used in poultry diet to enhance the performance of the immune response of birds (Ali Asghar Saki *et al*., 2012). One of such plant is *Moringa oleifera*, commonly known as the drumstick tree (Sarwatt *et al*., 2002). It is only available in few provinces which make it difficult and quite expensive to get.

However, *Moringa oleifera* has been reported to possess quality sources of several nutrients including protein, calcium, magnesium, potassium, iron, vitamin A, and vitamin C, vitamin E (Rweyemamu, 2006). The presence of vitamin C, vitamin E, carotenoids, flavonoids and selenium make *M.oleifera* a potential antioxidant (Moyo *et al*., 2012). The antioxidant compounds (phenols, Vitamin C, Vitamin E, β carotene, zinc, selenium, flavonoids) in *M. oleifera* have been reported (in some studies) to improve shelf-life and the quality of meat products in the pre-slaughter or post-slaughter stages that is incorporating natural antioxidants in animal diets or onto the meat surface or active packaging. According to Sarwatt *et al*. (2004), *M.oleifera* foliages are a potential inexpensive source for livestock feeding. Aregheore (2001) reported that the use of *M.oleifera* as a supplement can improve voluntary feed intake, digestibility and animal performance. It is also reported to have some health benefits in terms of healing and prevention in humans, such as diabetes relief, healthy skin, decreased depression and anxiety (Donovan, 2007), improved immune system, encourages balanced metabolism, healthy digestion (Life in Health., 2011). Its medicinal properties in animals have also been tested on previous studies for instance in goats by Moyo *et al.* (2012) and in broiler chickens by Qwele *et al*. (2013). Equally important is the fact that few parts of the tree contain toxins and other anti-nutritional factors that might decrease its potential as a source of food for animals or humans.

However, due to high feeding costs and low revenue generated, there is often inadequate

fund o buy drugs, which are expensive but may be mandatory, especially if antibiotics were to be banned in Nigeria. These farmers may benefit more from plants with immense nutritional value and medicinal properties such as *M.oleifera* leaves. Therefore, this research focuses on the use of *M.oleifera* as an additive in broiler diets and evaluate its effect on weekly growth performance, carcass characteristics broiler chickens

MATERIALS AND METHODS

Experimental Site

This experiment was conducted at the poultry unit of university of Abuja Teaching and Research Farm which is located along Airport Road, Gwagwalada, FCT-Abuja. Gwagwalada falls within latitude 90° 4'N, longitude 7° 28'E, 1500mm (59.1in) rainfall annually, average temperature of 18.45°C and relative humidity of 67% at 0900GMT (present). The zone has a particular rainy and dry season with a unimodal rainfall pattern which for the most part sets up between mid-May to early June, and tops in the long periods of the months of July/August. However, dry season starts from mid of October to end of April. The area has a daily mean temperature of 30^0C in the raining season and 34^0C in the dry season (Meteorological Station of Nnamdi Azikiwe International Airport (MET 2018).

Source of the Test Ingredients and Preparation of the Extracts

Fresh *Moringa oleifera* leaves were purchased in Madalla market Niger state. The leaves were air-dried 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 was then filtered to separate the debris from the filtrate, and the extracts were placed in clean containers and diluted using water (volume/volume) to form 20 ml/1litre of water for Treatment 2,40ml/1litre of water for Treatment 3, and 60ml/1litre of water for Treatment 4. 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 96day old broiler chicks were purchased from a good reputable and reliable farm. The birds were randomly allocated to four treatments of *Moringa oleifera* leaf extracts groups in a completely randomized design experimental model. Each of the treatment contain three replicates with eight birds per replicate. The birds were given the experimental treatment from day old to eight weeks of age. Treatment 1 was the Control of which routine antibiotics were used; Treatments 2, 3 and 4 were given 20ml,40ml and 60ml of *Moringa oleifera* leaf extract ml per liter.

Management of the Experimental Birds

Twelve (12) wire cage units, with an area of a square meter each that could accommodate eight broilers were used for this experiment. The cage was disinfected with Germicide (IZAL®) after washing with detergent and water. Newspapers spread were used as litter materials. Clean and disinfected feeders and drinkers were set in a place accessible to the birds. Each cage unit was properly labeled for easy identification of each treatment group. In addition, light was provided for the chicks to see and feed. The light also serves as source of heat for the brooding period. Commercial feed containing a crude protein (CP) content of 23 % and metabolizable energy (ME)

of 2800 kcal/kg were given to the birds during the first four weeks, and Finisher feed pellets containing 20 % CP and 3000 kcal/kg ME were given during the fifth week of age till the eight week. Feeds were given *ad- libitum* and shifting from one form of feeds to another were 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

Data was collected weekly for bodyweight at weekly intervals throughout the experimental period using a digital sensitive scale.

Carcass Evaluation

At the end of eight (8) weeks (56 days), two (2) birds were randomly selected per treatment for carcass evaluation; the birds were feed starved overnight, weighed, slaughtered and manually de-feathered. Weights of internal organs (liver, lungs, spleen, gizzard and heart) were recorded and the parameters below were estimated:

Dressing% = dress weight / live weight X 100
Organ/primal cut parts = weight of primal cut or organ

Statistical Analysis

The data collected was subjected to General Linear Model (GLM) procedure of analysis of variance (ANOVA) using Statistical Package for Social Science SPSS (2011) version 20. Significant differences among means were separated using Duncan's Multiple Range Test procedure (Duncan, 1955).

RESULTS AND DISCUSSION

Phytochemical Composition of Moringa oleifera Leaf

The composition reveals the presence of bioactive chemicals like alkaloids, saponins, Flavonoids, phenols, Terpenoids, tannins, streroids and oxalate. The value obtained are 2.44, 4.03, 10.21, 15.93, 5.07, 9.84, 2.82 and 0.74 (%) for alkaloids, saponins, flavonoids, phenols, terpernoids, tannins, steroids and oxalate respectively.

Table1: Phytochemical Composition of *Moringa oleifera*

Phytochemical Analysis	Composition (%)
Alkaloids	2.44
Saponins	4.03
Flavonoids	10.21
Phenols	15.93
Terpenoids	5.07
Tannins	9.84
Steroids	2.83
Oxalate	0.74

Phytochemical composition of *moringa oleifera*leaf reveals the presence of several bioactive chemicals or secondary metabolites which performs multiple biological activities. The present findings coincide with other research findings from Ngaha *et al*. (2016); Audu *et al*. (2018); Onyema *et al.* (2017). The presence of alkaloids confers the extract ability to function as an antibacterial, anti-malarial and anticancer; this supports the earlier findings of Alagbe, (2019). Flavonoids play a pivotal role as an anti-inflammatory, anti-allergic and anti-plasmodic (Sunil *etal*., 2016). Saponin performs both antibacterial and antifungal activities (Alagbe, 2020). Phenols are strong antioxidants which prevents the entry of diseases (Alagbe, 2019). Terpenoids has high therapeutic value and function as antimicrobial, anticarcinogenic and anti-diuretic. Steroids play a major role in fertility of animals (Atamgba *et al*., 2015; Alagbe, 2019). Tannins have found therapeutic application as antiviral and antibacterial (Adisa *et al*., 2010). Phytate are antioxidant compounds capable of binding minerals (Akpabio and Ikpe, 2013). Bioactive chemicals in plants vary according to species, age, soil type, geographical area and method of extraction (Omokore and Alagbe, 2019).

Relative Organ and Primal Cut Parts of Broiler Chickens Administered Different Inclusion Levels of *Moringa oleifera* Leaf Extract in their Drinking Water.

Relative organ and primal cut parts of broiler chickens administered different inclusion levels of *Moringa oleifera* leaf extract in their drinking water is presented in table 2. The head, neck, wings, liver, back, breast, gizzard, drumstick, thigh, heart and shank ranges between 2.55 – 2.69%, 4.57 – 5.33%, 7.30 – 10.41%, 2.13 – 2.51%, 16.00 – 17.46%, 20.41 – 23.56%, 2.55 – 2.86%, 9.67 – 10.47%, 0.46 – 0.56% 3.96 – 4.46 and 11.17 – 12.60% respectively.

The head, neck, wings, liver, breast, gizzard, drumstick, thigh, heart and shank were not significantly (P> 0.05) different among the treatments while back is significantly (P<0.05) influence by the treatments.

Table 2 Relative Organ and Primal Cut Parts of Broiler Chick ens Administer ed Different Inclusion Levels of *Moringa oleifera* Leaf Extract in their Drinking Water.

parameters	T1	T2	T3	T4	SEM
LW (g)	1872.66	1698.66	1865.33	1867.00	41.68
DP (%)	90.82	89.47	90.44	90.45	1.62
Head (g)	2.57	2.55	2.68	2.69	0.07
Neck (g)	4.57	5.33	5.28	5.10	0.14
Wings (g)	7.67	10.41	7.30	7.58	0.71
Liver (g)	2.15	2.13	2.28	2.51	0.17
Back (g)	15.03^{b}	17.46^{a}	16.00^{ab}	16.48^{ab}	0.39
Breast (g)	21.59	20.41	23.56	22.63	0.50
Gizzard (g)	2.86	2.77	2.55	2.67	0.66
Drumstick (g)	10.43	10.23	10.47	9.67	0.22
Thigh (g)	0.54	0.63	0.46	0.56	0.32
Heart (g)	4.35	4.47	4.10	3.96	0.18
Shank (g)	11.84	12.60	11.94	11.17	0.33

Means in the same row with different superscript are significantly different (P<0.05) SEM: standard error of mean; LW: live weight; DP: Dressing percentage.

Carcass and relative organ weights of birds revealed that there were no significant differences (P>0.05) in all the parameters examined among the treatments except the back cut which was significantly (P<0.05) influenced by the treatments. The neck, wings, back, gizzard, thigh, heart and shank weights were higher in T2 compared to T1, T3 and T4. The dressing percentage values were in close agreement with the findings of Oluwafemi *et al*. (2021) who examined the effect of garlic and oregano oil on the carcass characteristics of broiler chickens. Similar result was observed by Tihonen *et al*. (2007), who recorded a higher dressing percentage in birds when given diet supplemented with medicinal plants. The insignificant differences (P>0.05) observed among the various organs weights indicated that *Moringa oleifera* leaf extract is non-toxic since there was no noticeable inflammation on the internal organs of the animals. According to Alagbe (2017), presence of anti-nutritional factors is associated with enlargements of internal organs like liver, kidney, pancreas and spleen. Similarly, Bamgbose *et al*. (2004) reported that dress weight and internal organs weight characteristics are veritable indicators of the level of reduction or otherwise of anti-nutritional factors. Phytochemicals in the test material has proven to increase the absorption of nutrients which translates to a better final weight gain among birds. Alagbe (2019) work on the proven effects of phytobiotic feed additives in different poultry species, indicated a reduced feed intake, and improved feed conversion ratio. Pourali *et al*. (2010) suggested that antioxidants properties in medicinal plants promotes the performance of the intestinal flora thereby improving digestion and enhancing the utilization of energy, leading to improved growth. Similar, observations were made (Onu and Aja, 2011; Musa *et al*., 2020), in their study on weaned rabbits, they noted that these herbs may have controlled and limited the growth and colonization of numerous pathogenic and nonpathogenic species of bacteria in the gut leading to improved translation of feed to meat. Ramakrishna *et al*. (2003) also suggested that herbs supplementation enhances the activity of pancreatic enzymes and provides an environment for better absorption of nutrients.

Weekly Growth Performance of Broiler Chickens Fed *Moringa oleifera* Leaf Extract in their Drinking Water

Table 3 shows the weekly growth performance of broiler chickens fed *moringa oleifera* leaf extract in their drinking water. The result indicated that there were no significant (P>0.05) difference in the weekly growth performance except in week four where the growth differs significantly (P<0.05) where the highest live weight was recorded in T_4(503.83) followed by T_1, T_3 and T_2.

Table 3: Weekly Growth Performance of Broiler Chicken s Fed *Moringa oleifera* Leaf Extract in their Drinking Water.

Weeks	T1	T2	T3	T4	SEM
1	114.33	121.41	118.69	111.54	2.19
2	250.12	274.25	261.78	251.96	4.27
3	397.49	372.00	380.68	398.54	6.41
4	502.87^{a}	445.00^{b}	466.22^{ab}	503.83^{a}	9.58
5	624.99	581.17	619.33	644.96	11.04
6	1117.46	1013.04	1047.84	1090.17	18.60
7	1540.41	1503.25	1435.26	1412.62	34.40
8	1788.29	1681.62	1703.00	1785.79	27.48

Means in the same row with different superscript are significantly different (P<0.05)

The weekly growth performance of broiler chickens fed moringa leaf extract in their drinking water was presented in table 3. The result obtained shows that the leaf extract has no significant effect compared to control in all the weeks observed except in week four where higher mean value of weekly body weight was recorded in T_4 (60ml) which could be due to nutritional value of medicinal plant extract as reported by Moyo *et al*. (2011). However, the insignificant obtained in this studies may due to differences in environment, level of inclusion or management system.

CONCLUSION AND RECOMMENDATION

Medicinal plants are rich in secondary metabolites which are potential sources of drugs and essential oils of therapeutic importance. Medicinal plants are cheap, safe, effective and easily available. Dietary inclusion of *Moringa oleifera* leaf extract in broilers is capable of performing several pharmacological activities which includes: antioxidant, antimicrobial, anti-inflammatory, hepato-protective, hypolipidemic, cytotoxic etc. it can be used to further help to bridge the gap between food safety and production and can be included in the diets of broilers up to 60 ml per litre without causing any deleterious effect on the health and performance of birds.

Since the present study concluded that 60ml inclusion level of *Moringa oleifera* leaf extract has no detrimental effect on the performance and health status of birds, the study further recommends that *Moringa oleifera* leaf extract can be included up to 60ml per litre as an alternative to synthetic antibiotic growth promoters.

REFERENCES

Alagbe, J.O. (2017) effect of Miadasan as a dietary supplement on performance, carcass characteristic and blood profile of broiler chicken. *Scholarly Journal of Agricultural Science*. 7(2):27-33.7.

Alagbe, J.O. (2019). Effects of dried *Centella asiatica* leaf meal as herbal feed additive on the growth performance, haematology and serum biochemistry of broiler chicken. *International Journal of Animal Research*. 3(23): 1-12.

Alagbe, J.O. (2020). Performance, hematology and serum biochemical parameters of weaner rabbits fed different levels of fermented *Lagenaria brevifora* whole fruit extract. *Advances in Research and Reviews*, 2020, 1:5.

Aregheore, E.M., (2001). Nutritive value and utilization of three grass species by crossbred. *J. Anim. Sci.* 14: 1389-1393.

Audu, I.W., Audu, B.S and Suleiman, Y. (2018). Phytochemistry and proximate composition of root, stem bark and fruit of desert date, Balanites aegyptiaca. *Journal of Phytomedicine Research,* 7(6):464-470.

Duncan, D.B. (1955). New Multiple Range and Multiple F-test. Biometrics. 11: 1-42

Hernandez-Velasco, C. N. Vuong, B. Solis-Cruz, D. Hernandez-Patlan, J. D.Latorre, and G. Tellez Jr. 2019. Evaluation of in ovo Bacillus spp. based probiotic administration on horizontal transmission of virulent Escherichia coli in neonatal broiler chickens. *Poult. Sci*. 98:6483-6491.

Iqbal, S.; Bhanger, M. I. Effect of season and production location on antioxidant activity of *Moringa oleifera* leaves grown in Pakistan. *J. of Food Comp. and Anal.*2006, 19, 544-551.

Leeson S. (2000). Is feed efficiency still a useful measure of broiler performance. http://www.omafra.gov.on.ca/english/livestock/poultry/facts/efficiency.htm

Moyo, B., Masika, P.J., Hugo, A. and Muchenje, V. (2011). Nutritional Characterization of Moringa oleifera Lam leaves. *Afri. J.*

Biotech. 10, 12925-12933.

Musa, Bashir.Alagbe, J.O., Adegbite Motunrade Betty, Omokore, E.A. (2020). Growth performance, caeca microbial population and immune response of broiler chicks fed aqueous extract of Balanites aegyptiaca and

Mwale, M., and Masika, P., (2011). Toxicity evaluation of the aqueous leaf extract of Gunnera perpensa L.(Gunneraceae*). African. J. Biotech*.10:2503-2513.

Oluwafemi, R.A., Lawal, Aisha Omolade., Adelowo, Samad Adetope. and Alagbe,J. O. (2021). Effects of dietary inclusion of ginger (*Zingiber officinale*) and garlic (*Allium sativum*) oil (GGO) mixtures on carcass characteristics and sensory evaluation of broiler chickens.

Onu, P. N. and Aja, P. M. (2011) Growth performance and haematological indices of weaned rabbits fed garlic (*Allium sativum*) & ginger (*Zingiberofficinale*) supplemented diets. Inter. J. of Food, Agric. and Vet.Sci.Vol. (1)) Oct. _ Dec. 51-59

Pourali, M., Mirghelenj, S.A. and Kermanshashi, D. (2010) Effect of garlic powder on productive performance and immune response of broiler chickens challenged with Newcastle disease virus. *Global Veterinaria* 4:616-621

Rweyemamu, L.M.P., (2006). Challenges in the development of micronutrient-rich food ingredients from Soya beans and *Moringa oleifera* leaves: Moringa and other highly nutritious plant resources: Strategies, standards and markets for a better impact on nutrition in Africa, Accra, Ghana, November 16-18, 2006.

Sarwatt, S.V., Milang'ha, M.S., Lekule, F.P. and Madalla, N., (2004). Moringa oleifera and cotton seed cake as supplements for smallholder dairy cows fed napier grass. *Livestock Research for Rural Development.* 16:38.www.google.com, Accessed (28 November 2012).

Tihonen, A.; Celik, L.; Kutlu, H.R.; Gorgulu, M. (2007). Effect of dietary supplemental plant extracts on performance, carcass characteristics, digestive system development, intestinal microflora and some blood parameters of broiler chicks. In Proceedings of the 12th European Poultry Conference, Verona, Italy, 10–14 September 2006; pp. 10–14.