HAEMATOLOGICAL AND BIOCHEMICAL CHARACTERISTICS OF FINISHER BROILERS FED GRADED LEVELS OF *MORINGA OLIEFERA* LEAF MEAL

P.C. Okere, F.C. Egenuka, O.E. Kadurumba, E.B. Etuk, I.C. Okoli, and A.B.I. Udedibie
Department of Animal Science and Technology, Federal University of Technology, PMB 1526, Owerri, Nigeria
Corresponding author E-mail: okerepeacefuto@gmail.com Phone No.: 08060657957

ABSTRACT
The hematological and serum biochemical indices of finisher broilers fed graded levels of *Moringa oleifera* leaf meal (MOLM) were investigated in a - 28 day study. One hundred and fifty (150) five week old Anak strain broiler birds were randomly allotted to five dietary treatments in a completely randomized design (CRD). Each treatment had 3 replicates of 10 birds each. Five experimental diets with 0, 2.5, 5.0, 7.5 and 10% levels of inclusion of *Moringa oleifera* leaf meal were formulated. Feed and water were supplied ad-libitum. Three birds from each treatment were randomly selected and blood samples collated for hematological and serum biochemical evaluation at the end of the experiment. There were significant differences ($p<0.05$) in the packed cell volume (PCV) (41.50 – 50.0%), haemoglobin (HB) (13.8 – 16.8 g/dl) and red blood cells (RBC) (2.31 – 2.71 x 10^6) measured. The birds in T_3 (5.0%) recorded the highest values in PCV (50.0%), HB (16.8 g/dl), RBC (2.71 x 10^6/ml) and WBC (141.7%) compared to other treatment groups. However, WBC, MCH, MCV, neutrophils and Lymphocytes were not significantly ($p>0.05$) affected by the treatment diets. The serum biochemical indices measured showed significant differences ($p< 0.05$) in the serum cholesterol levels (111.50 – 148 mg/dl), total serum protein (4.9 – 6.0g/dl), level, AST level (29.50 – 264 iu/L) and ALT level (22.50 – 180. 5 iu/L). The control group had the highest values in serum cholesterol, total serum protein and serum globulin. The T_3 (5.0%) recorded the highest serum glucose level. Creatinine had the highest value in T_2 (2.5%). No significant differences ($p>0.05$) existed among the groups in the albumin levels, but T_3 had the highest value. It could therefore be concluded that *Moringa oleifera* leaf meal can be included into finisher broiler diets up to an inclusion level of 10% without any adverse effect.

Keywords: *Moringa oleifera*, leaf meal, finisher broilers

INTRODUCTION

The recent-emphasis on the need to research into alternative and sustainable livestock feed for ultimate performance, improved productivity, general carcass quality and reduced cost of production had made it emperative to pro-actively survey some of the indigenous plants with highly nutritional potentials for our animals and poultry in particular. *Moringa oleifera* is a plant readily available in almost all the parts of Nigeria and contains some anti-biotic compounds beside its nutritional value. It is an important plant species that has beneficial effect in human and livestock nutrition (Leone, *et al*, 2015). The leaves are very rich in carotene, ascorbic acid and in almost all the essential amino-acids (Olugbemi *et al.*, 2012). Apart from its great nutritional value, the leaves are used to relieve headache, stop bleeding, treat gastric ulcer and diarrhea, fever, bronchitis, eye and ear infections, inflammation of mucus membrane and scurvy skin (Gupta, *et al*, 2018). The seed has anti-bacterial and anti-inflammatory effect on wounds and insect bites. The flower juice enhances the quality and flow of breast milk and for treatment of urinary problems and cold. The pods are dewormers and can be used to treat liver and spleen problems as well as alleviating joint pain (Olugbemi *et al.*, 2012). It therefore becomes essential to consider the effects of this plant on the growth performance and hence, the effect on the blood and serum characteristics of animals. Haematological constituents reflect the physiological responsiveness of animals to their internal and external environment, while biochemical test has been used to determine the general situation of small animals (Esonu *et al.*, 2012).

This study therefore aims at investigating the effect of graded levels of *Moringa oleifera* leaf meal on the haematological and biochemical characteristics of finisher broilers.

MATERIALS AND METHODS

The experiment was conducted at the Teaching and Research Farm of the School of Agriculture and Agricultural Technology, Federal University of Technology, Owerri, Imo State, Nigeria in 2018. The serum biochemical and haematological analysis were carried out at the Federal Medical Center, Owerri, Imo State. The study lasted for 4 weeks (28 days). *Moringa oleifera* leaves used were obtained from SAAT farm FUTO.

Fresh *Moringa oleifera* leaves were harvested and dried under room temperature for 5-7 days and milled using a 2- mm stainless steel hammer mill. The *Moringa oleifera* leaf meal (MOLM) produced was stored in an air-tight plastic container under cool dry conditions before usage. Five dietary treatments were formulated with 0 %, 2.5 %, 5.0 %, 7.5 % and 10 % MOLM inclusion levels.

One hundred and fifty (150) finisher broilers of Anak breed five weeks of age were used in the experiment. The birds were randomly allotted to the five diets in a completely randomized design. Each treatment group had 3 replicates of 10 birds each. Feed and water were administered *ad-libitum*. At the end of the feeding trial, three birds were selected randomly from each treatment group and blood samples were collected from the wing veins to assess the blood profile of the birds.

A total of 7 mls of blood were collected from each bird. 2mls of each blood samples was placed into EDTA (Ethylene diamine tetracetic acid) treated bijou bottles for haematological assay while the remaining 5 mls of each blood sample was allowed to coagulate in vial bottles (without anticoagulant) for the serum biochemical studies. Blood was analyzed within three hours of collection for haemaglobin (HB), packed cell volume (PCV), Red blood cells (RBC), Mean corpuscular haemoglobin (MCH), Mean cell volume (MCV), white blood cell (WBC), neutrophils and lymphocytes levels. Blood serum biochemical indices determined include total serum protein, serum cholesterol, serum glucose, serum creatinine, albumin, globulin, AST and ALT levels.

Data obtained in the study were subjected to analysis of variance (ANOVA) and where significant differences were observed, means were separated using Duncan's New Multiple Range Test as outlined by Obi (1990).

Table 1: Ingredient and chemical composition of the experimental finisher broiler diets

Ingredients (%)	Diet 1 (0%)	Diet 2 (2.5%)	Diet 3 (5.0%)	Diet 4 (7.5%)	Diet5 (10.0%)
Maize (white)	60.00	58.00	56.00	54.00	52.00
Soybean meal	16.00	16.00	16.00	16.00	16.00
MOLM		2.50	5.00	7.50	10.00
Wheat offal	8.00	7.50	7.00	6.50	6.00
Palm kernel cake	7.00	7.00	7.00	7.00	7.00
Fish meal	2.00	2.00	2.00	2.00	2.00
Blood meal	3.00	3.00	3.00	3.00	3.00
Bone meal	3.00	3.00	3.00	3.00	3.00
Common salt	0.25	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25	0.25
Vit/min premix	0.25	0.25	0.25	0.25	0.25
L – lysine	0.25	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00	100.00
Calculated chemical composition (% d m)					
Crude protein	19.04	17.11	19.18	19.25	19.33
Crude fiber	3.81	3.80	3.79	3.78	3.76
Ether extract	3.78	3.75	3.73	3.70	3.67
Ash	2.96	3.06	3.16	3.26	3.36
Calcium	1.30	1.30	1.30	1.30	1.30
Phosphorus	0.70	0.71	0.72	0.72	0.73
L – methionine	0.57	0.59	0.60	0.62	0.64
L – lysine	1.31	1.40	1.49	1.58	1.67
ME (Mcal/kg)	2936.35	2930.91	2925.46	2920.02	2914.56

* *Moringa oleifera* leaf meal ** To provide the following per kilogram of feed: Vit. A, 10,000 iu, Vit. D3, 2000 iu; Vit. E 5 iu; Vit. K, 2 mg; Riboflavin, 4.20 mg; Vit. B12, 0.01 mg; Panthotenic acid, 5mg; Nicotinic acid, 20 mg, Folic acid, 0.5 mg; Choline, 3 mg; Mg, 5 mg, Fe, 20 mg; Cu 10 mg; Zn, 50 mg; CO, 125 mg.

RESULTS AND DISCUSSION

The ingredient and chemical composition of the experimental diets with different levels of inclusion of *Moringa oleifera* leaf meal (MOLM) is shown in table 1. Data on the haematological indices of the experimental birds are presented in table 2. Table 3 shows the result of serum biochemical indices of the finisher broilers. Results obtained in this study revealed that among all the haematological parameters measured, MOLM inclusion in broiler diets significantly ($p<0.05$) affected PCV (41.50 – 50 .0%), HB (13.8 – 16.8 g/dl) and RBC (2.31 – 2.71 x 106 /ml), although there were no consistent trend observed, but birds in T_3 (5.00%) recorded higher PCV level, HB level and RBC level compared to birds on other experimental diets. However, WBC, MCV, MCH, Neutrophils and lymphocytes were not significantly ($p>0.05$) affected by the treatments. The lower values of PCV, HB and RBC observed on T_1 (0%) were similar to the birds in T_2 (2.5%) and this could be attributed to the relatively low crude fibre content of the meal compared to T_3 (5.0%), T_4 (7.5%) and T_5 (10%) diets respectively. The importance of MCH and MCV lies in their use in the diagnosis of

Anemia and an index of capacity of bone marrow to produce RBC (Aletor and Egbeongbe, 1992, Okoli *et al 2013*, Esonu, *et al.*, 2010).

Table 2: Effect of graded levels of *Moringa oleifera* leaf meal on the haematological indices of finisher broilers

Indices	T_1 (0%)	T_2 (2.5%)	T_3 (5.0%)	T_4 (7.5%)	T_5 (10%)
PCV (%)	41.5[b]	42.0[b]	50.0[a]	46.5[a]	48.5[a]
HB(g/dl)	13.8[d]	14.0[d]	16.8[a]	15.5bc	16.2[ab]
RBC(x10^{12}/L)	2.32[d]	2.31[d]	2.71[a]	2.65[abc]	2.71ab
MCV(fl)	178.9	181.8	181.7	175.2	179.7
MCH(fl)	59.45	60.5	61.25	58.4	59.4
TWBC (%)	128.85	122.7	141.7	124.1	117.3
Lymph (%)	90	89.5	87.0	89.0	89.0
Neut(%)	10.0	10.5	13.0	11.0	11.0

[abcd] Means within the same row with different superscripts are significantly different ($p<0.05$).

The WBC count was highest in T_3 (5.0%) (141.7%) but was least in T_5 (10%) (117.3%). The higher values of WBC recorded in this study is suggestive of a well-adapted immune system. However, all the haematological parameters evaluated had values within the normal range and mean values of chicken as reported by Mitruka and Rawnsley (1997) and Banerjee (2008).

The serum indices assessed recorded the following: Total serum cholesterol (111.50 – 148mg/dl), serum glucose (120.50 – 144.40 mg/dl), creatinine (0.45 – 0.80mg/dl), total serum protein (4.9 – 6.00 g/dl), serum albumin (2.65 – 3.50g/dl), serum globulin (1.95 – 2.95 g/dl), AST (29.50 – 264 iu/L) and ALT (22.50 – 180.5 iu/L). Total serum cholesterol recorded significant difference ($p<0.05$) among the treatment groups, although the control group (T_1 0%) had the highest value (148.0 mg/dl). There was significant difference ($p<0.05$) on the serum glucose level between the control groups and T_2 (2.5%), T_3 (5.0%) and T_4 (7.5%). T_5 (10%) recorded the lowest serum glucose level while T_3 (5.0%) had the highest value. There existed no consistent trend of values observed on all the parameters analyzed. Creatinine had the highest value in T_2 (2.5%) (0.80 mg/dl) and the birds in T_5 (10%) (0.45 mg/dl) recorded the lowest value. The creatinine values obtained were within the normal physiological range and are indicative of normal functioning of the kidneys (Hammond and Belilies, 1980, Tamburawa, 2017 and Abeke, 1997). Total serum protein had the highest values in T_1 (0%) and T_3 (5.0%).

These values show that MOLM did not inhibit protein metabolism. The birds on T_3 (5.0%) also recorded the highest value. Serum globulin recorded the highest value in the control group T_1 (0%), while T_2 (2.5%) had the lowest value. The consequences of increased globulin were observed in chronic infections, liver damage and kidney dysfunction (Esonu *et al* 2006 and Sanchez – Monge *et al.*, 2004). The values of AST and ALT were within the normal ranges for birds and also an indication of normal functioning of the liver of the animals. The normal haematological and serum biochemical values obtained in this study portray the nutritional status of the birds and thus indicated adequate nourishment of the birds.

Table 3: Effect of graded levels of *Moringa oleifera* leaf meal on the serum biochemical indices of finisher broilers

Indices	T_1 (0%)	T_2 (2.5%)	T_3 (5.0%)	T_4 (7.5%)	T_5 (10%)	SEM
Cholesterol (mg/gl)	148.0[a]	127.0[c]	130.0[bc]	139.0[ab]	111.50[d]	3.10
Glucose (mg/dl)	127[c]	138.10[ab]	144.40[a]	139.10[ab]	120.50[c]	3.32
Creatinine(mg/dl)	0.55	0.80	0.75	0.65	0.45	0.06
Total Serum protein	6.0	5.35	6.00	4.9	5.7	0.39
Albumin (g/dl)	3.05	3.40	3.50	2.65	3.15	0.27
Globulin (g/dl)	2.95	1.95	2.50	2.25	2.55	0.25
AST (iu/L)	29.50[d]	172.50[b]	132.0[cd]	153.50[bc]	264a	7.25
ALT (iu/L)	22.50[d]	93[c]	101c	139.5[b]	180.5[a]	2.10

[abcd] Means within the same row with different superscripts are significantly different ($P<0.05$)

CONCLUSION

The results of the study had shown that *Moringa oleifera* leaf meal (MOLM) could be included into finisher broiler diets up to an inclusion level of 10% without any deleterious effects. The birds compared favourably with the control group.

REFERENCES

Abeke, F. O. 1997. Response of laying hens to dietary levels of sheep manure. M.Sc Thesis, Ahmadu Bello University, Zaria, Nigeria. Pp. 1-81.

Aletor, V.A. and Egberongbe, O. (1992). Feeding differently processed soybean part 2, assessment of haematological responses in chicken. *Die Nahrung*, 36: 367 - 370.

Banerjee, G.C. (2008). Textbook of Animal Husbandary. Bidhan Chandra krishi viswaridyalaya. Oxford and IBH publishing co. PVT Ltd.

Esonu, B.O., Emenalom, O.O., Udedibie, A.B.I., Herbert, U., Akpor, C.F., Okoli, I.C. and Iheukwumere F.C. (2008). Performance and blood chemistry of weaner pigs fed raw mucuna (Velvet bean) meal. *Trop. Animal Prod. Invest.,* 4: 49 – 54

Esonu, B. O., Emenalom, O. O., Udedibie, A. B. I. Anyawu, G. A., Aladu, U. and Inyang, A. O. (2005). Evaluation of Neem (Azadirachta Indica) Leaf meal on the performance, carcass characteristics and egg quality of laying hens. *Intl. Journal of Agric. Rural Development,* 6:208-212.

Esonu, B. O., Opara, M. N., Okoli, I.C., Obikaonu, H.O., Udedibie, A.B.I. and Ihesiulor O.O.M. (2006). Physiological responses of laying birds to Neem (Azaddiracta Indica) leaf meal basal diets, body weight, organ characteristics and heamatology. *Life science Journal 4(2): 37-41*.

Esonu, B. O., Emenalom, O. O., Udedibie, A. B. I. Anyawu, G. A., Aladu, U. and Inyang, A. O. (2012). Evaluation of Neem (Azadirachta Indica) Leaf meal on the performance, carcass characteristics and egg quality of laying hens. *Intl. Journal of Agric. Rural Development,* 6:208-212.

Gupta, S., Jair, R., Kachhwaha, S., and Kohari, S. L. (2018). Nutrirional and medicinal application of *Moringa oleifera* Lam-Review of current status and future possibilities. *Journal of Herbal Medicine* 11, 1 – 11.

Hammond, P.B. and Belilies, R.P. (1980). Metals in Toxicology. The basic science of poisons 2nd ed. 3 Doull, C.D. Klasen and M.O. Amdur oeds. Macmillan publishing co. Inc. New York, Pp. 409 – 467.

Mitruka, B.M. and Rawnsley, H.M. (1997). Clinical Biochemical and Haematological References Values in normal experimental animal masson. Publ. Co. New York.

Obi, I.U. (1990). *Statistical methods of detecting difference between treatment means* 2nd ed. Snaap Press Enugu, Nigeria

Okoli, I. C., Anunobi, M. O., Obua, B. E. and Enemor, V. (2011b). Studies on selected browses of South-eastern Nigeria with particular reference to their proximate and some endogenous anti-nutritional constituents. *Livestock Research for Rural Development, (15) 19 http://www.utafoundation.org/irrd159/oko1159.htm.*

Leone, A., Spade, A., Battezzati, A. Schirald, A., Aristil, J. and Bertoli, S. (2015). Cultivation, genetic ethnopharmacology, phytochemistry and pharmacology of Moringa oleifera leaves: An overview. *International Journal of Molecular Sciences* 16 (6), 12791 – 12835.

Olugbemi, T.S. Gambo, S.A., Orunnmmuyi, M.O. and Daudu M.O. (2012). Effect of feeding varying levels of *Moringa oleifera* powder on growth characteristics and organs weights in quails. In: *Processing of 37 Animal Production, University of Agriculture Makurdi, Benue State*. Pp: 205.

Sanchez – Monge, R., Lopez – Torrejou, G., Pascal, C.Y.V., Martin – Esterbam, M.J. and Sakedoi, G. (2004). Clinical and experimental Allergy, 34(11): 1747 – 1753.

Tamburawa, M. S., Abubakar, A. W., Hassan, A. M. and Madaki, S. (2017). Performance of Japanese quails fed diets containing *Moringa oleifera* leaf meal in Sudan-Savannah region of Nigeria. Production 42nd Ann. Conf. Nigerian Society for *Animal Production*, 26-30th March 2017, *Land Mark University, Omu-Aran*. Pg. 503 – 504

Esonu, B. O., Opara, M. N., Okoli, I.C., Obikaonu, H.O., Udedibie, A.B.I. and Ihesiulor O.O.M. (2006). Physiological responses of laying birds to Neem (Azaddiracta Indica) leaf meal basal diets, body weight, organ characteristics and heamatology. *Life science Journal 4(2): 37-41*.