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HAEMATOLOGICAL AND SERUM BIOCHEMICAL PROFILES OF BROILER CHICKENS FED DIETS CONTAINING MORINGA LEAF MEALS

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ABSTRACT

A study was carried out to determine the effects of Moringa oleifera leaf meal (MOLM) on the haematological and serum biochemical profile of broiler chickens. Fresh Moringa leaves (FML) were shade-dried for four days and milled into meal. A total of two hundred broilers unsexed chickens (Anak strain) were randomly allotted to five treatment groups at forty (40) birds per group. Each treatment group was further divided into five (5) replicates. MOLM was incorporated into the broiler starter and finisher diets at 0, 5, 10, 15 and 20% levels. The proximate composition of the MOLM showed percentage increases in crude protein, crude fibre, calcium and iron contents. The anti-nutritional factors showed higher tannin, phytic acid, saponin and oxalate contents in the MOLM than FML. The heamatological profile in the birds showed higher (p < 0.05) packed cell volume (PCV) in birds fed 5% MOLM and 15% MOLM, but lower in those fed 20% MOLM. The haemoglobin (Hb) values were similar (p>0.05) among birds fed 5%, 10% and 15% MOLM based diets, but reduced significantly (p<0.05) in birds fed 20% MOLM. The white blood cell (WBC) count was significantly (p<0.05) higher in birds fed 15% MOLM, while the lowest was observed in those fed with 20% MOLM. The serum biochemical indices showed significant (p<0.05) reductions in albumin, total protein, uric acid, aspartate amino transferase and alanine amino transferase in birds fed 20% MOLM. The creatinine content was significantly (p<0.05) higher in birds fed 20% MOLM based diet. It was therefore concluded that MOLM can be incorporated into broiler diets at 15% level without adverse effects on the haematological and serum biochemical indices of the birds.

Key words: Moringa leaf meal, broilers, haematology, serum profile

INTRODUCTION

The poultry industry in the developing countries is facing some challenges, one of which is increase in the cost of feed because of high prices of protein and energy sources (Abbas, 2013). Livestock feed costs in developing countries are a continuing challenge. The high and increasing prices for animal feeds have compelled researchers to direct their attention to non-conventional feed sources, with particular emphasis on protein substitutes. The use of leguminous multipurpose trees and shrubs has been suggested to be a viable alternative source of proteins, vitamins and minerals for poultry feeding. Plant leaves are commonly processed into leaf meals for use as poultry feed. Examples of the leaf meals which have been widely used in feeding non-ruminant animals include *Leucaena leucocephala, Gliricidia sepium, Sesbania sesban and Manihot esculenta* (Gadzirayi *et al.,* 2012).

However, Moringa *(Moringa oleifera)* is now presently being focused globally as another promising leaf meal in livestock feeding. Moringa is drought-tolerant and grows at a rainfall of 250-1500 mm per year (Martin, 2007). Rich in nutrients such as protein and minerals, Moringa is one of those plants that have not been studied for many years but now is being investigated for its fast growth, higher nutritional value, and increasing utilization as a livestock fodder crop (Nouman*et al*., 2013). The feeding value of Moringa has been reported to be analogous to that of soybeans and rapeseed meal (Soliva *et al.,* 2004). With the leaves of Moringa being rich in nutrients, pregnant women and lactating mothers use the powdered leaves to enhance their children's nourishment, principally in under-developed countries where malnutrition is common (Sudha *et al.,* 2010, Stephen *et al.,* 2008).

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Haematology has been defined as the study of blood and an important part of clinical pathology as well as diagnostic process (Lutz and Pryluski, 2008). Haematology includes not only the examination of the cellular and fluid portions of blood, but also includes a study of the tissues that form, store and circulate blood cells. However, the serum is the component that is neither a blood cell nor a clotting factor. It is the part of blood that is like water and that contains substances (called antibodies) that fight disease. Serum includes all proteins not used in blood clotting and all the electrolytes, antibodies, antigens, hormones and any exogenous substances (Martin, 2007).

The result of haematology and serum analysis is usually used to assess the health status of an animal. Haematological and serum parameters have been observed as good indicators of the physiological status of animal and their changes are important in assessing the response of such animal to various physiological situations (Khan and Zafar, 2005). This study was carried out to determine the effects of graded levels of *Moringa oleifera* leaf meal on haematological and serum biochemical profile of broiler chickens.

MATERIALS AND METHODS

Fresh leaves of *Moringa oleifera* were harvested within the premises of the Lagos State Polytechnic, Southwestern Nigeria. The harvested leaves were shade-dried for four days and milled in a hammer mill fitted with 2-mm sieve. The product here was tagged *Moringa oleifera* leaf meal (MOLM).

Experimental Diets

Five starter and finisher diets (Tables 1 and 2) were formulated for the study. *Moringa oleifera* leaf meal (MOLM) was added to the diets at 0, 5, 10, 15 and 20% levels. Minor adjustments were made in other ingredients to make the diets isonitrogeneous and isocaloric. Methionine and lysine were added into the diets at 0.3 and 0.1% levels so as to ensure the amino acids were not limiting.

Experimental Birds

Two hundred day-old broiler chicks (Anak strain) were randomly distributed into five treatment groups. Each group with 40 chicks was sub-divided into five replicates in a completely randomized design. Feed and water were supplied *ad-libitum*, and uniform light provided 24h daily. The house, feeding equipment and drinkers were thoroughly washed and disinfected before the arrival of the day old chicks. The birds were vaccinated against Newcastle disease on the 28th day and gumboro (infectious bursal disease) on the 10th and 35th day. Also, the birds were administered with medications against round worms and coccidiosis on the 39th, 41st and 47th days of the study. The experiment was terminated at the end of the eighth week.

Chemical Analyses

The chemical compositions of the fresh moringa leaves and MOLM were determined using the analytical procedures of AOAC (1990).

Analytical Measurements

In the 7th and 8th week of the experiment, blood samples (2 ml of blood for serum biochemical tests and 1ml of blood in vials with 2mg ethylene-diamine tetra-acetic acid (EDTA) for haematology) were collected from the jugular vein of the sampled birds (fifteen birds per treatment group). The Red Blood Cell, total White Blood Cell, haemoglobin, packed cell volume, monocytes and neutrophils were determined as described by Ewuola and Egbunike (2008). The mean corpuscular haemoglobin and mean corpuscular volume were determined using appropriate formulae as described by Emiola *et al.* (2013). Serum creatinine, alanine amino transferase, aspertate amino transferase, uric acid total protein and albumin were determined using methods described by Bahman *et al.* (2011).

Statistical Analysis

All data collected were analyzed using analysis of variance. Differences in means were separated using Duncan Multiple Range Test as described by Silva and Azevedo (2009).

RESULTS AND DISCUSSION

The results obtained on the chemical composition of the fresh moringa leaves (FML) and *Moringa oleifera* leaf meal (MOLM) are presented in Table 3. Lower moisture content was obtained in MOLM. Crude protein, crude fibre, ash, calcium, potassium, zinc, iron, tannin, oxalate, saponin and phytic acid contents were higher in MOLM than the FML. The data obtained on the chemical composition of the MOLM are similar to the findings of Aye and Adegun (2013). The reduction in the moisture content in the MOLM is consistent with earlier reports of Mbah *et al.* (2012) who processed Moringa leaves through sun-drying and shade drying methods. The crude protein content in the FML agrees with the findings of Gadzirayi *et al.* (2012). The higher crude protein content in the MOLM is similar to reports of Mbah *et al.* (2012) on shade-dried Moringa leaves. However, the crude protein content in the MOLM is lower than the amount obtained in the Moringa seeds as reported by Moreki and Gabanakgosi, (2014). The calcium, iron, potassium and zinc contents in the FML are similar to the reports of Aye and Adegun (2013). The anti-nutritional factors in the FML and MOLM agree with other reports which indicated presence of tannins, phenols, alkaloids, phytin and mimosine in Leucaena, Moringa and Gliricidia (Gadzirayi *et al.*, 2012).

Table 1: Percentage composition of broiler starter diets

Ingredients	Control	5%MOLM	10%MOLM	15%MOLM	20%MOLM
Maize	54.90	56.79	50.79	49.79	42.60
Soybean meal	20.00	13.00	13.00	12.00	12.00
Groundnut cake	10.00	12.00	14.00	12.00	10.00
Moringa	-	5.00	10.00	15.00	20.00
Fish meal	2.50	2.50	2.50	2.50	2.50
Wheat offal	4.00	3.00	2.00	2.00	3.00
Brewer Dried grains	2.70	3.00	3.00	1.75	2.00
Palm oil	1.00	3.00	3.00	3.00	3.00
Bone meal	2.00	2.00	2.00	2.00	2.00
Oyster shell	1.50	1.50	1.50	1.50	1.50
Salt	0.50	0.50	0.50	0.50	0.50
Premix	0.50	0.50	0.50	0.50	0.50
Methionine	0.30	0.30	0.30	0.30	0.30
Lysine	0.10	0.10	0.10	0.10	0.10
Crude protein (%)	22.89	22.79	22.74	22.76	22.54
MetabolizableEnergy (kCal/kg)	3101.21	3104.12	3024.35	3011.71	3001.40

MOLM - Moringa leaf meal. 0.50 premix supplied per kg of diet: vitamin A, 12,000 IU; vitamin D3, 2,000 IU; vitamin E, 50 IU; vitamin B1, 1 mg; vitamin B2, 3 mg; vitamin B6, 1 mg; vitamin B12, 10 µg; vitamin K, 2 mg; copper (cupric sulphate), 75 mg; nicotinic acid, 12 mg; pantothenic acid, 10 mg; iron, 200 mg; cobalt, 0.5 mg; manganese, 40 mg; zinc, 90 mg, iodine, 1 mg; selenium, 0.2 mg; calcium, 31.25 g; sodium, 10 g

Table 2: Proximate composition of finisher diets

Ingredients	Control	5%MOLM	10%MOLM	15%MOLM	20%MOLM
Maize	59.90	61.79	55.79	53.79	46.60
Soybean meal	15.00	8.00	8.00	8.00	8.00
Groundnut cake	10.00	12.00	14.00	12.00	10.00
Moringa	-	5.00	10.00	15.00	20.00
Fish meal	2.50	2.50	2.50	2.50	2.50
Wheat offal	4.00	3.00	2.00	2.00	3.00
Brewer Dried grains	2.70	3.00	3.00	1.75	2.00
Palm oil	1.00	3.00	3.00	3.00	3.00
Bone meal	2.00	2.00	2.00	2.00	2.00
Oyster shell	1.50	1.50	1.50	1.50	1.50
Salt	0.50	0.50	0.50	0.50	0.50
Premix	0.50	0.50	0.50	0.50	0.50
Methionine	0.30	0.30	0.30	0.30	0.30
Lysine	0.10	0.1	0.1	0.1	0.1
Crude protein (%)	20.01	19.97	19.89	19.86	19.87
Metabolizable Energy (kCal/kg)	2989.11	2987.16	2911.43	2904.37	2901.41

Abbreviations same as in Table 1

Table 3: Chemical composition of fresh Moringa leaves (FML) and shade-dried Moringa meal (MOLM)

Variable	FML (%)	MOLM (%)	%Δ
Moisture content(%)	65.1	6.4	-90.0
Crude protein(%)	6.7	22.6	+70.4
Crude fibre (%)	1.2	10.1	+88.2
Ether extract (%)	1.8	3.4	+47.1
Ash (%)	3.8	7.9	+51.9
Nitrogen-freeextract (%)	21.4	49.6	+56.6
Calcium (mg/100g)	4.21	6.98	+65.79
Iron (mg/100g)	1.76	2.98	+69.32
Potassium (mg/100g)	5.45	7.09	+30.09
Zinc (mg/100g)	4.42	5.89	+33.26
Tannin (mg/100g)	2.34	2.92	+24.79
Phytic acid (mg/100g)	41.34	42.68	+3.24
Oxalate (mg/100g)	4.48	5.01	+11.83
Saponin (%)	6.41	6.76	+ 5.46

Results on the heamatological profile of the birds are shown in Table 4. Higher ($p < 0.05$) values of packed cell volume (PCV) were observed in birds fed control diet, 5% MOLM and 15% MOLM, but significantly ($p < 0.05$) reduced in those fed 20% MOLM. The haemoglobin (Hb) values were similar ($p > 0.05$) among birds fed 5, 10 and 15% MOLM based diets, but reduced in those fed 20% MOLM. White blood cell was (WBC) significantly ($p < 0.05$) higher in birds fed control diet and 15% MOLM, but reduced ($p < 0.05$) in those fed 20% MOLM based diet. The red blood cells (RBC) and the monocytes were not significantly ($p > 0.05$) different across the groups of birds. The neutrophils were significantly ($p < 0.05$) higher in birds fed 15% MOLM, followed by 20% MOLM, 10%MOLM, 5% MOLM and control diet. The mean corpuscular volume (MCV) was significantly

Table 4: Haematological profile of broilers fed with Moringa leaf meal (MOLM)

	Diets					
Variable	Control	5%MOLM	10%MOLM	15%MOLM	20%MOLM	SEM
PCV(%)	25.00^{a}	24.00^{ab}	21.00^{c}	23.00^{b}	16.67^{d}	2.31
HB(g/dl)	8.30^{a}	7.97^{ab}	7.00^{b}	7.63^{b}	5.53^{c}	0.78
WBC (x10^{9}/l)	2.35^{a}	2.22^{b}	2.25 ^{b}	2.37^{a}	2.09^{c}	2567.26
MONOCYTE	0.33	0.33	0.67	0.33	0.00	0.21
NEUTROPHILS	24.00^{b}	28.67^{ab}	29.33^{ab}	33.33^{a}	30.33^{a}	1.74
RBC (x10^{12}/l)	3.94	3.76	3.65	3.81	3.07	2.15
MCV	4.99^{b}	2.74^{d}	5.87^{a}	5.42^{ab}	3.98^{c}	1.85
MCH	1.65^{b}	0.91^{d}	1.96^{a}	1.80^{ab}	1.32^{c}	0.62

Means with different superscripts across same rows are significantly ($p < 0.05$) different.
PCV - Packed cell volume; HB -Haemoglobin ; RBC - Red blood cell; WBC - White blood cell;
MCV - Mean corpuscular volume, MCH - Mean corpuscular haemoglobin

Table 5: Serum biochemical profile of broilers fed with Moringa leaf meal (MOLM)

	Diets					
Variable	Control	5%MOLM	10%MOLM	15%MOLM	20%MOLM	SEM
Albumin(mmol/l)	26.39^{a}	24.23^{b}	24.63^{b}	23.10^{b}	20.27^{c}	1.95
Protein(mmol/l)	43.05^{a}	41.58^{b}	41.79^{b}	42.09^{ab}	38.74^{c}	1.51
Uric acid (mmol/l)	4.15^{c}	5.28^{b}	5.83^{b}	5.21^{b}	7.48^{a}	0.52
Aspartate amino transferase(iu/l)	143.1^{a}	142.98 ^{a}	139.86^{b}	137.64^{b}	98.17^{c}	12.28
Alanine amino transferase (iu/i)	286.30^{a}	284.67^{a}	276.35^{b}	252.63^{c}	198.22^{d}	19.21
Creatinine (mmol/l)	71.00^{d}	73.40^{d}	79.45^{c}	82.56^{b}	120.41^{a}	9.13

($p < 0.05$) increased in birds fed 10% MOLM and 15% MOLM, but reduced in birds fed 5% MOLM and 20% MOLM. The mean corpuscular haemoglobin (MCH) was reduced in birds fed 5% and 20% MOLM based diets. The reduction in the PVC, Hb, RBC, WBC and neutrophils in birds fed 20% MOLM can probably be due to the combined effects of residual anti nutritional factors. In a similar study with rats, increasing inclusion level of Moringa leaf meal reduced the haematological indices (Odetola *et al.*, 2012). Studies have shown positive correlations between tannin, phytate and oxalate intakes and Hb and RBC in adult cockerels and broiler chickens fed raw jack beans and bambara groundunts, respectively (Akanji, 2002).

Data on the serum biochemical indices are shown in Table 5. The serum albumin content was significantly ($p < 0.05$) high in birds fed control diet, followed by 5% MOLM, 10% MOLM and 15%MOLM. Serum total protein contents were similar ($p > 0.05$) among birds fed control diet and 15% MOLM, but significantly ($p < 0.05$) reduced in those fed 20% MOLM. Lower and statistically similar ($p > 0.05$) values of uric acid were obtained in birds fed 5, 10 and 15% MOLM based diets, but significantly ($p < 0.05$) higher in those fed 20% MOLM. The aspartate amino transferase (ASMT) and alanine amino transferase (AMT) were similar ($p > 0.05$) among birds fed control diet and 5% MOLM, but significantly ($p < 0.05$) reduced in those fed 20% MOLM. The creatinine content was significantly ($p < 0.05$) higher in birds fed 20% MOLM based diet. Results obtained on the serum serum albumin and total protein were obtained. Beyond the 15% level of inclusion of MOLM, haematological and serum biochemical indices were reduced, thus implying the maximized effects biochemical indices showed marked reductions in serum albumin, total protein, aspartate amino transaminase and alanine amino transaminase in birds fed 20% MOLM based diet. The depressive effect of the MOLM at the 20% inclusion level could be attributed to the adverse influence of the Moringa phytotoxins namely lecithin, alkaloids like moringin, moringinine, glucosinolates, phenols including tannins, nitrite, oxalate and phytate (Odetola, 2012). These observations are similar to the findings of Vastana and Daramola (2014) who investigated the effects of Moringa leaf meal on haematological parameters and cholesterol content in rabbits. Consumption of MOLM in the diets at varying levels increased the concentration or amounts of creatinine and uric acid in the birds fed 20% MOLM. Elevated levels of creatinine and uric acid in response to increasing quantity of the leaf meal indicated that the fed animals had problem with the quality of the protein in the test feedstuff. These findings agree with the works of Aregheore (2002) who fed animals with high levels of Moringa product and reported poor results due to anti-nutrients.

CONCLUSION

From the results obtained in this study, it is concluded that the higher the inclusion level of MOLM in diets of broiler chickens the more the adverse effects on the haematological and serum biochemical profile. However, at 15% inclusion level of MOLM in the broiler diet, high values of haemoglobin, red blood cells, packed cell volume, of the toxic factors. Hence, it is recommended that MOLM can be incorporated into the diets of broiler chickens up to 15% level.

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REFERENCES

Abbas, T.E. (2013). The use of *Moringa oleifera* in poultry diets.Turkish Journal of Veterinary and Animal Science. 37: 492-496

Akanji, A.M. (2002). Enhancing the utilization of someTropical legume seeds in diets Of Exotic chickens.Ph.D Thesis. University of Ibadan

Aregheore, E.M. (2012). Intake and digestibility of *Moringa oleifera*- Batiki grass mixtures by growing goats. Small Ruminant Research 46: 23-38

Aye, P.A. and Adegun, M.K. (2013). Chemical composition and some functional properties of moringa, leaucaena and gliricidia leaf meals. Agriculture and Biology Journal of North America 4(1) 71-77

Bahman, AH., Alireza, T. and Siamak, A.R. (2011). Comparative Study on Blood Profiles ofIndigenous and Ross-308 Broiler Breeders Global Veterinaria 7 (3): 238-241

Emiola, I.A., Ojediran, T.K. and Ajayi, J.A. (2013). Biochemical and heamatological indices of broiler chickens fed differently processed legume seed meals. Int. Journal of Applied Agricultural and Apicultural Research 9 (1&2): 140-149

Ewuola, E.O., Egbunike, G.N. (2008). Haematological and serum biochemical response of growing rabbits bucks fed different levels of dietary fumonisin African J. Biotech, 7: 4304-4309

Gadzirayi, C.T., Masamha, B., Mupangwa, J.F. and Washaya, S. (2012). Performance of broiler chickens fed on mature moringaoleifera leaf meal as a protein supplement to soyabean meal. International Journal of Poultry Science 11 (1): 5-10

Khan, T.A. and Zafar, F. (2005). Haematological study in response to varying doses of estrogen in broiler chicken. International Journal of Poultry Science.10:748-751

Lutz, C. and Pryztulski, K. (2008). Nutrition and Diet Therapy.4th Ed Jaypee Brothers Medical Publishers. New Delhi pp 312

Martin, L.P. (2007). The moringa tree.Echo. North Fort Myers, FL 33917, USA. Available at: http://www.echonet.org

Martin, E.A. (2007). Concise Medical Dictionary (7th Ed) Oxford, England, Oxford University Press

Mbah, B.O, Eme, P.E and. Paul, A.E. (2012) Effect of drying techniques on the proximate and other nutrient composition of *Moringa oleifera* leaves from two areas in Eastern Nigeria. Pakistan Journal of Nutrition 11 (11): 1044-1048,

Moreki, J.C. and Gabanakgosi, K. (2014). Potential use of Moringa oleifera inpoutry diets. Global Journal of Animal Scientific Research 2 (2): 109-115

Nouman, W., Basra, S.M.A, Siddiqui, M.T., Yasmeen, A, Gull, T. and Alcayde, M.A.C. (2013). Potential of *Moringa oleifera* L. as livestock fodder crop: a review. Turkish Journal of Agriculture and Forestry. 37(1) 1-14.

Odetola, O.M., Adetola, O.O., Ijadumola, T.T., Adedeji, O.Y andAdu, O.A. (2012). Utilization of Moringa leaf meal as a replacement for soya bean meal in rabbit's diets. Journal of Agricultural Science 2 (12) 309-313

Silva, F. and Azevedo, C.A.V. (2009). Principal components analysis in the software Assistant Statistical Attendance. In: World Congress on Computers in Agriculture. American Society of Agricultural and Biological Engineers.

Soliva, C.R, Kreuzer, M, Foidl, N, Foidl, G., Mach, M.A. and. Hess, H.D. (2004). Feeding value of whole and extracted moringaoleiferaleaves for ruminants and their effects on rumen. Animal Feed Science and Technology, 118 (1), 47-62.

Stephen, K., Bangert, M. A. William, J, Marshall, A. and William, L. (2008). Clinical Biochemistry Metabolic and Clinical Aspects, Elsevier, Philadelphia

Sudha, P., Asdaq, S.M., Dhamingi S.S. and Chan, G.K. (2010). Immuno-modulatory activity of methanolic leaf extract of *Moringa oleifera*in animals. Indian Journal of Physiology and Pharmacology, 54 (2), 133-140

Vantsawa, P. A. and Daramola, A. (2014). The effect of *moringa oleifera* leaf meal (molm) on the hematological parameters and the cholesterol level of rabbits. American Journal of Biological, Chemical and Pharmaceutical Sciences, 2 (3), 1-6