Blood Characteristics of Finisher Broiler Chickens Fed Graded Levels of *Moringa oleifera* Seed Meal

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Abstract
A 28-day experiment was conducted to determine the effects of graded levels of *Moringa oleifera* seed meal (MOSM) on the blood profile of finisher broiler chickens. One hundred and twenty (120) finisher broiler chickens of Ross 308 strain were divided into four groups of 30 birds each and each group replicated three times. Four diets were formulated such that Diet 1 contained no MOSM while Diet 2, 3 and 4 contained MOSM at 0.5%, 1.0%, and 1.5%, respectively. Each group was randomly assigned to one of the four experimental diets in a completely randomized design. Feed and water were provided *ad*-libitum. At the end of the experiment, three birds from each treatment were randomly selected and blood samples collated for haematological and serum biochemical evaluation. Data collected were analysed using SPSS Software (2013). Means were separated using the software. The result of the study showed that the Haemoglobin HB, Red Blood Cells RBC, MCH and MCHC values of all the treatment groups were similar ($P<0.05$). The Packed Cell Volume PCV, and MCV values of the birds in diet 3 and diet 4 were significantly ($P<0.05$) lower than that of the birds in diet 1 and diet 2. The WBC values across the treatment groups were similar ($P>0.05$). The result of the serum biochemical determination, showed that the creatinine value of the birds in diet 4 was significantly ($P<0.05$) higher than that of birds in diets 1, 2 and 3. Urea, sodium, potassium and chloride values were similar ($P>0.05$) across the treatments. The haematological and serum biochemical values across the treatment groups fell within the normal range for healthy chickens. It is therefore concluded that *Moringa oleifera* seed meal can be included into broiler diets up to 1.0% without any toxic effect on the birds. MOSM at 1.5% level resulted to the high value of serum creatinine, indicating kidney disfunction.

Keywords: Haematological, Serum biochemical, *Moringa oleifera*, Finisher broilers

Introduction

Nigeria is one of the countries where animal protein intake of the people ranks among the lowest FAO (2007). High cost of conventional feed ingredients is a major challenge affecting the expansion of poultry industry in Nigeria, Okere, (2024). Feed cost accounts for about 70 - 80% of the total cost of production (Esonu, *et al.*, 2018). The revenue accruing from the sales of poultry and their products cannot compensate for the cost of production of the same. This invariably escalated the market price of livestock products out of the reach of the common man.

There is, therefore, an urgent need to investigate alternative feed resources that could efficiently replace the conventional feed ingredients in poultry diet and also serve as prophylactic agents.

The ingestion of numerous dietary materials has measurable effects on blood constituents and blood provides accurate measures for long term determination of the nutritional status of an animal (Ogbuewu, *et al.*, 2023). Haematological constituents reflect the physiological responsiveness of animals to its internal and external environment while biochemical test has been used to determine the general situation of small animals (Chidozie, *et al* 2022; Esonu, *et al.*, 2018).

One of the tropical plants that have been receiving attention recently in poultry nutrition is *Moringa oleifera. Moringa oleifera* seeds have phytogenic properties and are natural growth promoters and additives, i.e. the seeds of *Moringa oleifera* have been found to be good sources of fats, proteins, vitamins and minerals (Kamboh, *et al.*, 2018). The seeds are good anti-oxidants which invariably reduces oxidative damages on the body. It becomes essential to consider the effects of the seeds of *Moringa oleifera* on the haematological and serum biochemical indices of animals. This study therefore aims at investigating the effects of graded levels of *Moringa oleifera* seed meal on the blood profile of finisher broilers chickens.

Materials and Methods

The research was carried out in the poultry unit of the Teaching and Research farm of the school of Agriculture and Agricultural Technology (SAAT), Federal University of Technology Owerri (FUTO), Imo State, Nigeria. Owerri is the capital of Imo State and it is in the South-Eastern Agricultural Zone of Nigeria. Owerri is located at an altitude of 90m (Atlas of Imo State, 1984). The mean annual rainfall, temperature and humidity are 2500mm, 27.5 C and 70 -80%, respectively. The duration of the dry season (that is the number of months with less than 65mm of rainfall) 3

months and the mean annual evaporation is 140mm (Atlas of Imo State, 1984).

The serum biochemical and haematological studies was carried out at Links Medical Diagnostic and Research Laboratory, Owerri. Freshly harvested *Moringa oleifera* seeds were spread on a well-ventilated room to dry within 7 - 10 days and milled with a 2mm stainless steel harmer mill to produce *Moringa oleifera* seed Meal (MOSM). The *Moringa oleifera* seed meal (MOSM) produced was stored in an air-tight plastic container under cool dry conditions before feed formulation. Four dietary treatments were formulated with 0%, 0.5%, 1.0% and 1.5% MOSM inclusion levels. The ingredient composition of each of the experimental diets is shown in Table 1.

One hundred and twenty (120) finisher broilers of Ross 308 strain were used in the experiment. The birds were randomly allotted to the four 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 their veins to determine the blood profile of the birds. A total of 7mls of blood were collected from each bird. Two mls of each blood sample were placed into EDTA (Ethylene diamine tetracetic acid) treated bijou bottles for haematological analysis while the remaining 5mls of each blood sample were allowed to coagulate in vial bottles (without anticoagulant) for the serum biochemical studies. Blood was analyzed within three hours of collection for haemoglobin (HB). Packed cell volume (PCV), Red blood cells (RBC), Mean corpuscular haemaglobin (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 analysed using SPSS Software (2013) and where significant differences were observed, Means were separated using same SPSS Software package (2013).

The ingredient and chemical composition of the experimental diets with different levels of inclusion of *Moringa oleifera* seed meal (MOSM) is shown in Table 1.

Table 1: Ingredients and Chemical Composition of Broiler Finisher Experimental Diets

Ingredients (%)	Diet 1 (0%)	Diet 2 (0.5%)	Diet 3 (1.0%)	Diet 4 (1.5)
Maize	60.00	60.00	60.00	60.00
Soybean meal	20.00	19.50	19.00	18.00
MOSM	0.00	0.50	1.00	1.50
Wheat offal	8.00	8.00	8.00	8.00
Palm kernel cake	4.00	4.00	4.00	4.00
Fish meal	2.00	2.00	2.00	2.00
Blood meal	2.00	2.00	2.00	2.00
Bone meal	3.00	3.00	3.00	3.00
Common Salt	0.25	0.25	0.25	0.25
Vit/min premix	0.25	0.25	0.25	0.25
L – lysine	0.25	0.25	0.25	0.25
L – methionine	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00
Calculated chemical composition (% of dm)				
Crude protein	19.12	19.70	10.18	19.25
Crude fiber	4.28	4.79	4.494	1.494
Ether extract	3.86	3.89	1.087	1.087
Ash	2.91	2.95	4.478	4.566
ME(Kcal/kg)	2936.35	2930.91	2925.46	2920.02

[*]*Moringa oleifera* leaf meal[**] to provide the following per kilogram of feed: Vit. A, 10,000 IU, Vit. D3, 2000 iu; Vit. E 5iu; 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

Data on the haematological indices of the experimental birds is presented in Table 2. Table 3 shows the result of analysis of the serum biochemical indices of the finisher broiler chickens. The result of the haematological study showed that the Haemoglobin HB, Red Blood Cells RBC, MCH and MCHC values of the treatment groups were similar (P>0.05). This is in contrast with the report of Okere, *et al.*, (2024), who found significant differences (P<0.05) among the treatment groups in HB, RBC, MCH and MCHC and almost all the haematological indices investigated in broiler chickens fed increasing levels of *Moringa oleifera* leaf meal. The HB, RBC values were within the reference values of 7 - 7g/dl and 1.59 - 4.10^{12}/L reported for healthy chickens by Mitruka and Rawnsley, (1997). This may indicate similarity in the diets in terms of nutrient digestibility and utilization. The packed cell volume (PCV), and Mean cell volume (MCV) of the birds in Diet 3 and Diet 4 were significantly (P<0.05) lower than that of birds in Diet 1 and Diet 2. The WBC values across the treatment groups were similar (P>0.05).

The significantly low PCV values obtained among the groups offered MOSM at 0.5, 1.0 and 1.5% inclusion levels indicate low ability of the diet to support the cellular components of the blood. The comparable values of the MCH and MCHC indicate that the quality of proteins in the treatment diets is similar to the control (Ogbuewu, *et al*., 2023), which suggests that the nutrient qualities of the diets were not compromised by 1.5% inclusion level of MOSM in the diet of finisher broiler chickens.

The significantly low MCV in broiler chickens fed 1.0% and 1.5% MOSM suggests that the RBC are smaller than normal and may indicate microcytic anemia (Okere, *et al*., 2024). This could be attributed to anti-nutritional factors (Uchegbu, *et al.*, 2014) present in the experimental diet, which reached a threshold level beyond the tolerance level of the birds.

WBC has been reported to fight toxic foreign bodies (Roberts, *et al.*, 2023). The slight increase in WBC values of broilers fed 0.5, 1.0 and 1.5% MOSM in this study shows possibility of toxicity of the diet (Akinmutimi *et al.*, 2014).

The non-elevated neutrophil / lymphocytes ratio indicates that the experimental broiler chickens were not subjected to severe nutritional challenge. Although there were significant (P<0.05) differences in platelet count of the finisher broiler chickens fed 0.5,1.0 and 1.5 dietary levels of MOSM, these values were within the range (40-80 x 10^9/L) reported for healthy chickens (Mitruka and Rawnsley, 1997). The comparable platelet values indicate that the bleeding time (a measure of how fast or small blood vessels in the skin stop bleeding) of birds in the treatment diets are similar to that of the control, which implies that the platelet function was not compromised by the incorporation of up to 1.5% MOSM in the diet of finisher broiler chickens.

However, all the haematological parameters evaluated had values within the normal range and mean value of chickens as reported by Mitruka and Rawnsley, (1997) and Banerjee (2018).

Table 2: Effect of Dietary MOSM on Haematological Indices of Finisher Broiler Chickens

Parameters	Diet 1 (0%)	Diet 2 (0.5%)	Diet 3 (1.0%)	Diet 4 (1.5%)	Reference values	SEM
PCV (%)	26.33^a	0.30^a	23.33^b	22.70^b	21.00 - 42.00	0.73
HB (gldl)	16.20	14.50	14.87	15.93	7.00 - 17.00	0.43
RBC (10^{12}/l)	2.58	2.09	2.34	2.51	1.59 - 41.00	0.31
MCV (fl)	04.17^a	104.23^a	100.90^b	97.47^c	90 - 140.00	1.07
MCH (pg)	62.93	70.57	66.63	60.93	33 - 77.70	2.67
MCHC (gldl)	61.53	62.60	61.37	61.37	26 - 85.00	1.13
PLT (10^a/l)	57.00	46.33	50.00	51.67	40.00 - 80.00	3.52
WBC (10^a/ l)	88.00	88.67	89.33	88.33	50.00 – 100.00	1.70
NEUT. (%)	13.67	10.00	13.67	11.00	3.00 – 21.00	1.58
MONO (%)	1.67	1.33	1.33	1.33	0.00 – 3.95	0.15
EOS (%)	1.07	1.00	1.33	1.33	0.00 – 4.40	0.24
BAS (%)	0.67	0.67	1.00	0.67	0.00 – 2.00	0.13

abc Means within a row with different superscripts are significantly (P<0.05)
SEM: Standard Error of the Mean

The result of the serum biochemical determination, showed that the creatinine value of the birds in diet 4 was significantly (P<0.05) higher than that of diet 1, diet 2 and diet 3 birds. Urea, sodium, potassium and chloride values were similar (P<0.05) across the treatments.

Blood biochemical constituent have been shown to be positively correlated to the quality of the diets (Ogbuewu, *et al.,* 2015; Pritchet and Corning, 2014). The similar serum potassium, sodium and chloride values among the dietary groups indicate that inclusion of up to 1.5% MOSM in the diet of finisher broiler chickens had no deleterious effect on the concentrations of serum electrolyte balance. The significantly higher level of serum creatinine (is a breakdown product of creatine phosphate from muscle and protein metabolism) at 1.5% MOSM suggests poor kidney function, which could be due to anti-nutritional factors contained in the test feed ingredient reaching a limit beyond the bird's acceptable level.

Table 3: Effect of Graded Levels of *Moringa oleifera* Seed Meal on Serum Biochemical Indices of Finisher Broiler Chickens

Parameters	Diet 1 (0%)	Diet 2 (0.5%)	Diet 3 (1.0%)	Diet 4 (1.5%)	SEM
Urea (mg/dl)	4.00	3.50	3.40	4.33	0.29
Creatinine (mg/dl)	0.31[b]	0.31[b]	0.33[b]	0.40[b]	0.01
Na (mg/dl)	140.67	143.33	144.00	142.67	1.66
K (ml/l)	4.37	4.70	4.37	4.43	0.19
Cl (mmol/l)	106.33	107.33	106.33	104.33	1.03

[abc] Means within a row with different superscripts are significantly ($p<0.05$)
SEM: Standard Error of the Mean

Conclusion

The results of the study had shown that *Moringa oleifera* seed meal (MOSM) could be included into finisher broiler diets up to 1.0% level without any deleterious effects.

Moringa oleifera seed meal (MOSM) enhanced HB, RBC, PCV, and MCV values at up to 1.0% in finisher broiler chickens, indicating better physiological status of the experimental birds.

MOSM at 1.5% level of inclusion resulted to the high value of the serum creatinine, indicating kidney dysfunction.

References

Akinmutimi, A. H., Aligwara, A. O. and Abasiekong, S. F. (2014). The effect of quantitative replacement of soya bean meal with cooked and toasted lima bean meal on growth performance and carcass quality values of broiler finisher birds. *J. Agrrc. Biotec. Environ 4: ½*

Atlas Imo State, (1984). Imo State Ministry of Works and Transport (IMWT) (1984). Atlas of Imo State, Nigeria. Domegge di cadore: C and G company.

Banerjee, G. C. (2018). Textbook of Animal Husbandary. Bidhan Chadra Krishiviswaridyalaya. Oxford and IBH publishing co. PVT Ltd.

Chidozie, Freedom Egbu, Lebogang Ezra Motsei, Azeez 0lanrewaju Yusuf, Caven Mguvane Mnisi. (2022). Evaluating the efficacy of *Moringa oleifera* seed extract on nutrient digestibility and physiological parameters of broiler chicks. *Farm animal production.*

Esonu, B. O., Emenalom, O. O., Udedibie, A. B. I., Herbert, U., Akpor, C. F., Okoli, I. C. and Iheukwumere, F. C. (2018). Performance and blood chemistry of weaner pigs fed raw mucuna (Velvet bean) meal. *Tropical animal production Invest.* 4: 49 – 54.

Food and Agricultural Organization FAO, (2007). Fishery Country profile. The Federal Republic of Nigeria. Retrieved from: http://ftp.fao.org/fi/document/fcp/cn/FI CP NG. pdf.

Kamboh, A. A., Khan, M. A., Kaka, U., Awad, E. A., Memon, A. M., Seed, M. and Kama, C. (2018). Effect of dietary supplementation of phytochemicals on immunity and haematology of growing broiler chickens. *Ital. J. Anim. Sci*. 1038 – 1043.

Mitruka, B. M. and Rawnsley, H. (1997). Clinical biochemical and haematology reference values in normal experimental animals. Publishers New York.

Ogbuewu, I. P., Modsaojang-Mojnanaja, M. M. C., Mokolopi, B. G. and Mbajiorgu, C. A. (2023). Nutritional and chemical composition of Black velvet tamarind (Diaium guineease Wild) and its influence in animal production: A review. Open Agric. 8 (2023) 20220174

Ogbuewu, I. P., Emenalom, O. O., Okoli, I. C. (2015). Alternative feedstuff and their effects on blood chemistry and haematology of rabbits and chickens. A review. Comparative Clinical Pathology, 26 (2): 277 - 286. Dio. 10.1007/s00580-015-2210-0.

Okere, P. C., Egenuka, F. C., Kadurumba, O. E., Etuk, E. B., Okoli, I. C. and Udedibie, A. B. I. (2024). Haematological and biochemical characteristics of finisher broilers fed graded levels of *Moringa oleifera* leaf meal. *International Journal of Agriculture and rural development* Vol.27: No1. 2024, 6877

Okere, P. C. (2019). Studies on the nutritional and anti-microbial effects of *Moringa oleifera* leaf meal on broilers and laying hens. PhD. Thesis 2019. Federal University of Technology, Owerri, Imo State of Nigeria.

Pritchet, K. R, Corning B. F. (2014). Biology and medicine of rats. Renter, K. M., Suckow, A. M., In Roberts K. , Daryl, K.G., Peter A. M., Victor W. R. (2023) Harpers Biochemistry, 25th edn. M. C. Graw-Hill, New York, 25: 763-765

SPSS Inc. (2013). Statistical Package for Social Sciences. S.P.S.S. Base 22.0 Users Guide, Copyright © 2013. SPSS Inc., 233 South Wacker Drive, 17th Floor, Chicago. IL 6060 - 6412 .

Uchegbu, M.C., Ogbuewu, I. P., Ezebuiro, L. E. (2017). Blood chemistry and haematology of finisher broilers fed plantain (*Musa paradisiaca L.*) peel in their diets. *Comparative Clinical Pathology*, 26: 605 - 609.