

HAEMATOLOGICAL INDICES OF BROILER BIRDS FED DIETS CONTAINING DIFFERENT LEVELS OF PAWPAP (*Carica papaya*) LEAF MEAL

¹Nsa, E. E., ¹Archibong, E. E., ^{1*}Umoren, E. P., ²Nsa, K. E. and ¹Kperun, T. N.

¹Department of Animal Science, University of Calabar, Calabar, Nigeria.

²Department of Social Science Education, University of Calabar, Calabar, Nigeria.

*Corresponding author: etidoumoren@yahoo.com, +2348036689785

Abstract

The study was conducted to investigate the haematological indices of broiler finisher birds fed varying dietary levels of pawpaw leaf meal. A total of one hundred and twenty (120) 28-day old broiler chickens (Arbor Acre strain) was used and the study lasted for 28 days. The birds were randomly allocated to four groups. Each group was replicated three times in a Completely Randomized Design. Experimental diets were made to contain 0%, 1%, 2% and 3% of analysed pawpaw leaf meal, to represent treatments 1, 2, 3 and 4, respectively. Blood samples were collected through neck slitting from 3 birds per replicate for haematological indices. The result of the proximate composition showed that pawpaw leaf meal contained 25.89% crude protein, crude fibre 10.34%, ether extract 1.00, ash 15.66% and nitrogen free extract 47.11%. The result showed that all haematological indices were significantly ($p < 0.05$) influenced by the inclusion of pawpaw leaf meal (PPLM), except for the mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC). The mean packed cell, haemoglobin, lymphocytes, monocytes, eosinophils and heterophils increased with increased in dietary PPLM. It is concluded that pawpaw leaf meal the PPLM which is high in crude protein, ash and crude fibre though low in ether extract, can support and improve the health status of broiler finisher birds.

Keywords: Pawpaw leaf; feed resources; broiler birds; haematology.

Description of Problem

The haematological and serum biochemical parameters of birds are critical indicators of their health status (1). Haematological indices such as packed cell volume (PCV), red blood cell (RBC) count and hemoglobin concentration provide information on the oxygen-carrying capacity and general physiological status of birds. Broiler production is highly dependent on the quality of feed, which must provide the necessary nutrients for optimal growth and health (2). To improve feed efficiency and bird performance, antibiotics are always added in their feeds, however, due to global restrictions on the use of antibiotics due to its residual effects on humans, attention has been shifted to natural alternatives of plant origin such as garlic, neem, ginger, bitter leaf, and pawpaw leaf (3, 4, 5, 6), each containing bioactive compounds like alkaloids, flavonoids and phenolic acids.

Pawpaw (*Carica papaya*) is a tropical plant, characterized by a single, un-branched stem, large paliunate leaves, and fruit rich in nutrients. The leaves are particularly valued for their nutritional and medicinal properties (7). Pawpaw leaves contain 18-35% crude protein, 10-11% ash and essential minerals like calcium,

phosphorus and iron. However, it also contains low levels of anti-nutritional factors, such as phytates, oxalates, alkaloids, flavonoids, tannins, saponins and phenolic compounds (8). These bioactive compounds make pawpaw leaves a promising feed additive for improving health and performance in broiler chickens. The objective of this study was to determine the effect of dietary inclusion of pawpaw leaves on the haematological profile of broiler finisher birds.

Materials and method

The research was carried out in the Poultry Unit of the Department of Animal Science Teaching and Research Farm of the University of Calabar, Cross River State, Nigeria.

A total of one hundred and twenty (120) 4-week-old Arbor Acre breed of broiler chickens (managed previously on commercial feed) of average weight 650.30g, were used for the experiment. They were housed in a deep litter house partitioned into several pens with wire mesh to allow for adequate ventilation. The birds were allotted into four treatments of thirty birds each and three replicates of 10 birds each in a completely randomized design. Feeds and

water were given *ad libitum* throughout the 28 days of the duration of the experiment.

The pawpaw leaves were gotten from farms within the University community. The leaves were plugged fresh from mature plants, washed and air dried for 2 days to a constant moisture content, thereafter, milled in a meadow model 35 hammer mill and sieved through a mesh of 5mm to obtain pawpaw leaf meal. The meal was then made to partially replace wheat offal and palm kernel cake in broiler finisher mash (Table 1). The following dietary treatments were employed; birds were allotted to treatments 1, 2, 3 and 4 with 0, 1, 2 and 3% pawpaw leaf meal, respectively.

At the end of the feeding trial 5ml of blood samples were collected from nine birds per treatment group (3 birds per replicate) through neck slitting into sterile disposable hypodermic syringes and were transferred immediately into plastic tubes containing anti-coagulant ethylene diaminitetra-acetic acid (EDTA) for haematological studies. The obtained data were subjected to analysis of variance using the SPSS software, and where analysis of variance indicated significant treatment effects, means were compared using Duncan's New Multiple Range Test (DMRT) (9).

Table 1: Gross composition of experimental diets

Ingredients	T1(0% PPLM)	T2(1% PPLM)	T3(2% PPLM)	T4(3% PPLM)
Maize	59.25	59.25	59.25	59.25
Wheat offal	4	3.5	3.0	2.5
Palm kernel cake	3	2.5	2.0	1.5
Pawpaw leaf	0	1	2	3
Soybean meal	28	28	28	28
Fish meal	2	2	2	2
Bone meal	2	2	2	2
Intestine	1	1	1	1
Lysine	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25
Vit/min premix*	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00
Calculated values				
Crude protein (%)	21.05	21.16	21.19	21.21
ME (Kcal/kg)	3100.22	3095.18	3090.90	3085.02

*Premix (vitamin/mineral mixture) Vitamin A, 12,000,000 IU; Vitamin D3, 2,000,000 IU; Vitamin E, 1000 mg; Vitamin K3, 2,000 mg; Vitamin B 1000 mg; Vitamin B2 500 mg; Panthotenic acids, 1,000 mg; Nicotinic acid 3000 mg; Folic acid 1000 mg; Manganese, 6000 g; Zinc, 5000 g; Iron, 3000 g; Copper, 20 1000 g; Iodine, 1000 g; Selenium, 100 mg; Cobalt, 1000 mg;

Results and Discussion

The proximate composition of PPLM (Table 2) showed that it contains 25.89% crude protein, 10.34% crude fibre, 1.00% ether extract, 15.66% ash and 47.11 NFE, which was a sharp contrast to the values obtained by (10) which were 32.13, 12.11, 0.41, 12.48 and 42.87% for the respective compositions. The differences may be due to different sources of pawpaw leaves varieties. The crude fibre content obtained in this study may be considered moderate for monogastric, ether extract is considerably low and the level of ash content is indicative of its high mineral content previously reported (11).

Table 3 showed the results of haematological indices of broiler finisher chickens fed graded level of PPLM diets. Overall, the

haematological indices were significantly ($p < 0.05$) influenced by the inclusion of pawpaw leaf meal, except the mean corpuscular hemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC). The mean packed cell volume (PCV) compared favourably to the range (32.33 - 36.66%) reported by (12) which increased with increase in dietary levels of PPLM. It implies that the protein content of the diets was not only adequate since the values were within normal range for healthy birds but that pawpaw leaf is rich in protein (Table 1). According to (13), low level of PCV is an indication of anaemia. Therefore, the birds were not anaemic across the treatment diets. Haemoglobin concentration ranged between 11.11-13.65g/dl but higher than 6.35g/dl reported (14) for local chickens

and tended to significantly ($p < 0.05$) increase as the dietary PPLM increased in the diets. Thus, the dietary treatments seemed to be capable of supporting high oxygen carrying capacity blood in broiler birds. The lymphocytes, monocytes, eosinophils and heterophils showed significant differences ($p < 0.05$) across the experimental treatment diets and seemed to increase with increased PPLM in the diet. This observation showed a well-developed immune system, an indication of good health. The whole blood cells which increased significantly ($p < 0.05$) with dietary PPLM, an indication of the immune-stimulant properties of pawpaw leaves (15).

The values of PCV, RBC, WBC and Hb obtained in this study were within the normal range of 27.43% - 37.30% RBC, $1.97 \times 10^{12}/L$ - $3.75 \times 10^{12}/L$ RBC; $3.98 \times 10^9/L$ - $10.82 \times$

$10^9/L$ WBC and 7.50 g/dl - 16.04 g/dl Hb reported by (16) who investigated a comparative study of haematological values of four different broiler strains (Ross, Arbor acres, Cobb and Arian). This shows that the bone marrows of the birds were functioning normally which revealed the absence of macrocytic and hypochronic anaemia (12).

Table 2: Proximate composition of pawpaw leaf (%)

Nutrients (%)	Composition
Dry matter	86.44
Crude protein	25.89
Ether extract	1.00
Crude fibre	10.34
Ash	15.66
Nitrogen free extract	47.11

Table 3: Effect of pawpaw leaf meal on haematological indices of broiler finisher chickens

Parameters	T ₁	T ₂	T ₃	T ₄	SEM
PCV (%)	32.41 ^c	32.60 ^c	33.60 ^b	34.92 ^a	2.08
RBC ($\times 10^9/L$)	2.82 ^c	2.90 ^c	3.84 ^b	4.12 ^a	0.52
WBC ($\times 10^9/L$)	6.01 ^b	6.09 ^b	6.34 ^a	6.39 ^a	0.30
Hb (g/dl)	11.11 ^b	11.14 ^b	11.31 ^b	13.65 ^a	1.39
MCV (fl)	120.00	125.12	129.50	116.43	6.00
MCH (pg)	41.82	39.33	36.02	40.92	3.44
MCHC (g/dl)	30.99 ^b	31.05 ^b	28.77 ^a	26.13 ^a	1.07
Lymphocytes (%)	29.14 ^b	29.28 ^b	32.44 ^b	34.97 ^a	2.00
Heterophils (%)	59.08 ^b	59.09 ^b	60.05 ^b	65.88 ^a	3.11
Eosinophils (%)	1.90 ^c	2.15 ^b	2.14 ^b	3.98 ^a	0.13
Basophils (%)	0.00	0.00	0.00	0.00	0.00
Monocytes (%)	1.82 ^b	1.85 ^b	1.89 ^b	2.20 ^a	0.01

^{a,b,c} means along the same row with different superscripts are significantly ($p < 0.05$) different

SEM - Standard Error of Mean

PCV = Packed Cell Volume, RBC = Red Blood Cell, WBC = White Blood Cell, Hb = Haemoglobin, MCV = Mean Corpuscular Volume, MCH = Mean Corpuscular Haemoglobin, MCHC = Mean Corpuscular Haemoglobin Concentration

Conclusion and Application

This research concluded that the nutrient were adequately utilized by the broiler chickens and posed no problem to the birds. Study revealed that pawpaw leaf which is rich in crude protein, fibre and ash can enhance health status of broiler birds and farmers can supplemented 3% of wheat offal/palm kernel cake with PPLM in finisher broiler diets, sustainably.

References

1. Jiwuba, P.C., Kuka, T.T., Kadurumba, O.E. and Nwachukwu, C.O. (2017). Evaluation of haematological and serum biochemical characteristics of *Annona muricata* (Soursop) leaf extract on broiler birds. *Int. J. Res. Stud. Micro. and Biotech.*, 3. 6-11.
2. Nsa, E. E., Ozung, P. O., Etuk, E. A. and Archibong, E. E. (2023). Economics and effect of replacing wheat offal with cassava peel meal on growth performance, nutrient digestibility of growing pigs. *African Journal of Food, Agriculture, Nutrition and Development*. 23(8).24423-24442.
3. Hashemi, S. R., & Davoodi, H. (2012). Herbal plants as new immuno- stimulator in poultry industry: A review. *Asian Journal of Animal and Veterinary Advances*, 7, 105–116. <https://doi.org/10.3923/ajav.2012.105.116>.

4. Nsa, E. E., Okon, B., Ozung, P. O., Anya, M. I., Wogar, G. S. I. and Umoren, E. P. (2011). (2011). Proximate composition, anti-nutritional factors and growth response of broiler finishers fed raw and thermal treated *Milletia obanensis* seed meal. *Journal of Agricultural and Veterinary Science*. 3: 95-102.
5. Ukoha, O. A., Umoren, E. P., Nsa, E. E., and Ejuvwevwo, O. G. (2025). Growth performance, carcass characteristics and economics of production of broiler chickens fed diets containing bitterleaf (*Vernonia amygdalina*) meal. *Journal of Research in Agriculture and Animal Science*. 12. 01-08. 10.35629/9459-12070108.
6. Umoren, E. P., Iso, I. E., Anya, M. I., & Ayuk, A. A. (2025). Performance and linear body measurements of WAD goats fed *Panicum maximum* supplemented with cassava and *Aspilia africana* leaves. *Journal Of Agriculture, Forestry & Environment*, 9(1), 159-176.
7. Ugbogu, E. A., Emmanuel D. Dike, Miracle Ebubechi Uche, Lotanna R. Etumnu, Benedict C. Okoro, Ositadinma C. Ugbogu, Oluwapelumi E. Adurosakin, Chiemela Enyinna Chinma, Esther Ohaeri, Emeka J. Iweala (2023). Ethnomedicinal uses, nutritional composition, phytochemistry and potential health benefits of *Carica papaya*. *Pharmacological Research - Modern Chinese Medicine*, 7, 100266, <https://doi.org/10.1016/j.prmcm.2023.100266>.
8. Ampode, K. M. B. (2019). Papaya (*Carica papaya* Linn.) leaf meal as phytobiotic feed supplement improves the production performance of growing Japanese Quails. *International Journal of Biosciences*, 14 (5), 533 - 540.
9. SPSS (2012). Statistical Package for Social Science, version 21. USA. IBM corporation.
10. Kelvin, M. B. (2019). Papaya (*Carica papaya* Linn) leaf meal as phyto biotic feed supplement in Japanese quails. *International Journal of Biosciences (IJB)*, 14(5): 534-541.
11. Ezieshi, E. U. and Olomu, J. M. (2011). Biochemical and evaluation of yam peel for broiler chicken. *Journal of Agricultural and Social Research*, 11(1): 36-47.
12. Summola, T. A., Tuleun, C. D. and Oluremi, O. I. A. (2019). Growth performance, blood parameters and production cost of broiler chickens fed dietary sweet orange peel meal diets with and without enzyme addition. *Nigerian Journal of Animal Production* 46(1): 37-50.
13. Bot, M. H., Ajimohun, F. F., Stephen, R. R., Olaiya, O. D., Daniel, L. N. and Udokainyang, A. D. (2019). Haematological response of broiler chickens to garlic (*Allium sativum*) as an additive. *Nigerian Journal of Animal Production*, 46(4):45 - 51.
14. Mitruka, B. M. and Rawasley H. (1977). *Clinical Biochemistry and Haematological Reference Values in National Experimental Animals*. 1st Edition. New York, USA. Masson Publishing Inc. pp 106.
15. Olomu, S. M. (2001). *Monogastric Animal Nutrition Principles and Practice*. A Jachem Publication. Benin City, Nigeria. Pp 67 - 107.
16. Telebi, A., Asu-Razael, S., Roseh-Chai, R. and Sahrael, R. (2005). Comparative studies on haematological values of broiler strains (Ross, Arbor acres, Cobb and Arian). *International Journal of Poultry Science*, 4(8): 573-579.