APRW -55

Effect of Turmeric (*Curcuma longa*) Meal on the Haematology and Serum Biochemistry of Broiler Chickens

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Abstract
A total of one hundred and twenty day-old Anak-strain broiler chick to determine the effect of turmeric (*Curcuma longa*) meal on the haematology and serum biochemistry of broilers. A completely randomized design was used and the experiment lasted for eight weeks. The birds were grouped into four diets (D1, D2, D3 and D4) respectively. D1 served as control, D2 contained 1.0 % turmeric, D3 contained 2.0 % and D4 contained 3.0 % turmeric at both growth phases respectively. Blood samples were collected for haematological indices and serum biochemical indices examination. The results of haematology and serum biochemistry revealed significant ($p<0.05$) difference in the values obtained for ALT, urea, haemoglobin, PCV, RBC and MCHC. The highest values were obtained in D4 for Hb (8.13 g/dl), PCV (29.50 %) and RBC (2.72 x 10^6/µl). MCHC recorded the highest value in D1 (31.04 g/dl) and the least in D3 (27.35 g/dl). Highest values of alanine aminotransferase were obtained in D2 (44.33 µl) and its least value in D1 (14.33 µl). Serum urea had (0.87 mg/dl) and the highest value was observed in D2 (8.75 mg/dl). The cholesterol values were within the normal range. The same trend was noticed for urea, RBC and Hb. The high value of the WBC suggests that the birds were immunologically challenged. It was concluded that the inclusion of turmeric meal did not affect the serum biochemistry and haematology of the birds but elevated the WBC count out of normal range.

Keywords: Effect, turmeric, haematology, serum biochemistry and broiler.

Introduction

In Nigeria, commercial poultry production is expanding daily. However, the high cost of feed and poor utilization of feed ingredient have been observed to be the major constraints militating against the efficient development of poultry industry and the supply of adequate quantities of protein to meet up the teeming population (Mutassim and Hunaiti, 2008). The high cost of feed is mainly due to scarcity resulting from the competition for these feed stuffs between man, industries and animals. The agricultural and industrial waste products are poorly utilizable by most non-ruminant especially poultry (Nwadibia and Amaefule, 2016). This has thus necessitated research into non-conventional feedstuffs for livestock.

Turmeric (*Curcuma longa*) is a spice used mainly for their nutritional and medicinal potentials. The rhizome is usually cleaned, boiled, and dried or milled in the fresh raw form to yield a yellow powder called turmeric. The most important chemical compounds in turmeric are a group of compounds called curcuminoids which include curcumin (diferuloylmethane), demethoxycurcumin, bisdemethoxycurcumin (Wuthi-Udomler *et al*., 2000) and tetrahydrocurcumoids (Osawa *et al*., 1995) as well as volatile oils (turmerone, alantone, and zingiberone). Curcumin is the major essential oil and is responsible for the yellow colour of turmeric. Plant extracts were found to have anti-fungal and anti-oxidative value. Some pharmacological activities of turmeric (*Curcuma longa)* as nematocidal (Kiuchi *et al*., 1993) and anti-inflammatory (Ammon *et al*., 1993) were demonstrated. Moreover, (Soni *et al*., 1997) proved the protective effects of turmeric as food additives on aflatoxin-induced mutagenicity and hepato-carcinogenicity.

The blood transports or conveys nutrients and materials to different parts of the body. Therefore, whatever that affects the blood, whether drugs, pathogenic organism or nutrition will certainly affect the entire body adversely or moderately in terms of health, growth, maintenance and reproduction (Oke *et al*., 2007). A readily available and fast means of assessing clinical and nutritional health status of animals on feeding trials may be the use of blood analysis, because ingestion of dietary components has measurable effects on blood composition and may be considered as appropriate measure of long term nutritional status (Olabanji *et al*., 2007).

This study was used to determine the effect of turmeric (*Curcuma longa*) meal on the haematology and serum biochemistry of broilers.

Materials and Methods

The study was carried out in the poultry unit of the teaching and research farm of Michael Okpara University of Agriculture, Umudike which is geographically located in Abia State on latitude $05^0 29^l$ North, longitude $07^0 33^l$ East and at an altitude of 122 m above sea level. It lies within the humid rainforest zone of West Africa (NRCRI, 2015). A total of one hundred and twenty (120) day-old Anak strain broilers were used for the study. The birds were randomly allocated to four (4) treatments; each treatment was replicated three times with 10 broilers per replicate. The broilers were housed in a tropical-type, open-sided poultry house roofed with zinc roofing sheets. The open side of the house was covered with expanded metal and iron nets to

prevent flies and other insects' entry. The broilers were provided experimental feed and water *ad libitum*. Routine medications/vaccination (Coccidiostat, Lasota and Gumboro) were administered to the birds during the experiments.

Turmeric (*Curcuma longa*) rhizome was washed, boiled for 15 minutes and sundried for 3-4 days, milled and bottled in an air-tight container against contamination. Four dietary treatments designated as D1, D2, D3 and D4 contained 0, 1.0, 2.0 and 3.0 % respectively turmeric powder inclusion thoroughly mixed into the diets for both starter and finisher phases.

The experimental design was Completely Randomized Design (CRD) with model:

$Y_{ij} = \mu + T_i + e_{ij}$ Where: Y_{ij} = Single observation; μ = Overall mean; T_i = Treatment effect; e_{ij} = Experimental error.

Table 1: Percentage composition of boiled/dried turmeric meal diets fed to broilers

	Starter Diet				Finisher Diet			
Ingredients	D1	D2	D3	D4	D1	D2	D3	D4
Maize	45.00	44.00	43.00	42.00	51.00	49.00	48.00	46.00
Maize offal	5.00	5.00	5.00	5.00	6.00	6.00	6.00	6.00
Soybean meal	23.00	20.00	20.00	20.00	22.00	23.00	23.00	22.00
Wheat offal	9.00	9.00	9.00	9.00	9.00	9.00	7.00	8.00
PKC	4.00	7.00	7.00	7.00	3.00	3.00	4.00	4.00
GNC	8.00	8.00	8.00	8.00	4.00	4.00	4.00	4.00
Turmeric	0.00	1.00	2.00	3.00	0.00	1.00	2.00	3.00
Fish meal	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Bone meal	1.00	1.00	1.00	1.00	0.50	0.50	1.00	2.00
Oyster shell	1.50	1.50	1.50	1.50	1.00	1.00	1.50	1.50
Vit/min premix	0.10	0.10	0.10	0.10	0.20	0.20	0.20	0.20
Methionine	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Lysine	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Salt	0.20	0.20	0.20	0.20	0.10	0.10	0.10	0.10
Total (%)	100	100	100	100	100	100	100	100
Calculated Analysis								
ME (kcal.kg)	2935.60	2901.26	2866.92	2832.58	3008.29	2970.61	2929.62	2839.64
C.P (%)	22.79	22.68	22.59	22.49	21.07	21.29	21.06	20.61
E.E (%)	7.20	7.17	7.13	7.09	6.99	7.09	7.04	6.82
C.F (%)	4.40	4.42	4.46	4.38	4.31	4.32	4.25	4.24
Lysine (%)	1.26	1.26	1.26	1.26	1.19	1.22	1.20	1.18
Methionine(%	0.47	0.47	0.46	0.46	0.45	0.46	0.45	0.45
Ca (%)	1.20	1.20	1.20	1.21	0.82	0.82	1.20	1.57
P (%)	0.84	0.84	0.84	0.84	0.65	0.66	0.81	1.13

ME=Metabolizable energy, CP=Crude protein, EE=Ether extract, CF=Crude fibre, Ca=Calcium and P=Phosphorus.

Blood samples were collected from the right Jugular vein into sample bottles containing Ethylene Diaminetetraacetic Acid (EDTA) for haematological determinations, while that of serum biochemistry was without EDTA to allow blood clotting and serum decanted for the analysis. Packed cell volume (PCV) and erythrocyte counts were determined as described in Ewuola and Egbunike (2008). Total leukocyte counts were determined using Neubauer haemocytometer after appropriate dilution. Blood constants (Mean cell volume, MCV, Mean cell haemoglobin, MCH, and Mean cell haemoglobin concentration, MCHC) were determined using appropriate formulae by Jain (1986). Serum total protein was determined using Biuret method (Kohn and Allen, 1995). ALT, AST, Cholesterol, glucose and urea concentrations were determined by the method described by Tuffery (1995).

Data obtained were subjected to analysis of variance (ANOVA), in a Completely Randomized Design (Steel and Torrie, 1980), and differences among treatment means were separated using Duncan's Multiple Range Test (Duncan, 1955).

Results and Discussion

Haemoglobin concentration of birds fed turmeric diet were significantly ($p<0.05$) different. Haemoglobin values observed in this work fell within the range (7-12 g/dl) given by Jain (1993) which also tallied with the work of Iheukwumere and Herbert (2012). Significant ($p<0.05$) difference were observed in PCV of birds fed turmeric diet. These values appeared to be in normal range in relation to reference values reported by Jain (1986) which says that PCV value falls within the range of 22.00-35.00 %. Campbell (2013) reported a normal PCV range 30-35 % for normal broiler which did not agree with the findings of this study. Low PCV may be as a result of anemia as reported by Campbell (2013). RBC agrees with the result of Ewuola and

Egbunike (2008). WBC values obtained in this analysis were not significantly ($p>0.05$) different. This agreed with Ewuola and Egbunike (2008) result but had higher values when compared to that of Jain (1993). MCV, MCH were not significant; MCHC was significantly ($p<0.05$) different. The values obtained in MCV, MCH and MCHC where in harmony with the reports of Iheukwumere and Herbert (2012).

Table 2: Haematological parameters of broilers fed turmeric flavoured diet.

Parameters	D1	D2	D3	D4	SEM
Hb conc. (g/dl)	7.55^{ab}	7.12^{b}	7.77^{ab}	8.13^{a}	0.24
PCV (%)	24.33^{b}	24.67^{b}	28.50^{a}	29.50^{a}	0.85
RBC (x10^{6}/µl)	2.22^{b}	2.25^{b}	2.35^{ab}	2.72^{a}	0.13
WBC (x10^{3}/µl)	8.33	10.95	13.10	8.07	2.57
MCV (fl)	109.78	111.29	121.14	108.63	6.13
MCH (pg)	34.04	32.19	33.14	30.01	2.20
MCHC (g/dl)	31.04^{a}	28.84^{ab}	27.35^{b}	27.57^{b}	0.72

^{a,b,} Means along the same row with different superscript are significantly different ($p<0.05$).

Table 3: Serum biochemical parameters of broilers fed turmeric flavoured diet.

Parameters	D1	D2	D3	D4	SEM
Total protein (g/dl)	3.91	3.39	3.55	3.17	0.28
AST (µl)	109.67	145.00	149.00	184.33	23.54
ALT (µl)	14.33^{c}	44.33^{a}	19.00^{bc}	33.67^{ab}	5.48
Glucose (mg/dl)	186.33	160.00	186.00	188.67	10.05
Cholesterol (mg/dl)	178.95	196.49	166.32	160.00	20.40
Urea (mg/dl)	0.87^{c}	8.75^{a}	6.93^{ab}	5.72^{b}	0.59

^{a,b,} Means along the same row with different superscript are significantly different ($p<0.05$). AST = Aspartate aminotransferase; ALT = Alanine aminotransferase

All the parameters measured were not significantly ($p>0.05$) different except ALT and urea (Table 3). The values obtained from serum protein, urea and cholesterol in this study were within the normal range of values comparable to those reported by Campbell (2013). The marker enzymes, Alanine aminotransferase (ALT) differed significantly as the levels of turmeric powder varied. Usage of boiled/dried turmeric as feed additive did not affect the glucose level of the blood. The results of AST and ALT were not in agreement with the results of El-Kerdaway (1996) while Abdel-Azeem *et al*. (2000) showed that level of AST reduced although ALT was not significantly affected. D1 decrease in urea might be due to anabolic hormonal effects and liver failure.

Conclusion

It was concluded that the inclusion of turmeric spice in broiler diets did not affect the haematology and serum biochemistry of the birds but elevated the WBC count.

References

Abdel-Azeem, F., El-Hommosany, Y.M. and Nematallah A.G.M. (2000). Effect of citric acid in diets with different starch and fibre levels on productive performance and some physiological traits of growing rabbits. Egypt *J. Rabbit Sci.,* 10: 121-145.

Ammon, H.P., Safayhi, H., Mack, T. and Sabieraj, J. (1993). Mechanism of anti-inflammatory actions of curcumin and boswellic acids. *J. Ethnopharmacology,* 38: 113-119.

Campbell, T.W. (2013). Processing in avian haematologic sample. Avian Haematology. P. 8:9.

Duncan, D.B. (1955). Multiple Range and Multiple F-Tests. *Biometric,* 11: 1-42.

Ewuola, E.O. and Egbunike, G.N. (2008). Haematological and serum biochemical response of growing rabbits bucks fed different levels of dietary fumonisin B_1. *African Journal of Biotechnology*, 7 (23): 4304 - 4309.

Iheukwumere, F.C. and Herbert, U. (2012). Physiological responses of broiler chickens to quantitative water restrictions: haematology and serum biochemistry. *J. Poult. Sci.*, 2: 117-119.

Jain, N.C. (1986). Scanning electron micrograph of blood cells. In: *Schalm's Veterinary haematology*. 4th ed. Lea and Febiger. Philadelphia.

Kiuchi, F., Goto, Y., Sugimoto, N., Akao, N., Kondo, K. and Tsuda, Y. (1993). Nematocidal activity of turmeric and synergistic action of curcuminoids. *Chem. Pharm. Bull (Tokyo),* 41: 1640-43.

Kohn, R.A. and Allen, M.S. (1995). Enrichment of proteolitic activity relative to Nitrogen in preparation from the rumen for in vitro studies. Animal Feed Science and Technology, 52 (1/2): 1-14.

Mutassim, M. and Hunaiti, D.A. (2008). The effect of dietary yeast and protected methionine on performance and trace minerals status of growing Awassi lambs. *Livest. Sci.,* 115: 235-241.

NRCRI (2015). Meteorological Data.National Root Crop Research Institute, Umudike, Nigeria.

Nwadibia, C.C. (2016). Performance of broilers fed low energy and low protein diets supplemented with multi-enzyme in the humid tropics. M.Sc. Thesis, Michael Okpara University of Agriculture, Umudike, Nigeria.

Oke, U.K., Herbert, U., Ebuzoeme, C.O. and Nwachukwu, E.N. (2007). Effect of genotype on the haematology of Nigerian local chickens in humid tropical environment. *Proc. of 32nd Annual Conf. of the Nig. Soc. for Anim. Prod.* Pp. 18-21.

Olabanji, R.O., Farinu, G.O., Akinlade, J.A. and Ojebiyi, O.O. (2007). Growth performance, organ characteristics and carcass quality of weaner rabbits fed different levels of wild sunflower (*Tithonia diversifolia* Hemsl A. Gray) leaf-blood meal mixture. *Int. J. Appl. Agric. Apic. Res.,* 2(12): 1014-21.

Osawa, T., Sugiyama, Y., Inayoshi, M., and Kawakisi, S. (1995). Antioxidation activity of lower Tetrahydrocurcuminoids *Biotechnological Biochemistry,*59: 1609-61.

Soni, K.B., Lahiri, M., Chackradeo, P., Bhideand, S.V. and Kuttan, R. (1997). Protective effect of food additives on aflatoxin-induced mutagenicity and hepatocarcinogenicity. *Cancer Letters,* 115: 129-33.

Steel, R.G.D. and Torrie, T.H. (1980). *Principles and procedure of statistics: A Biometrical Approach,* 2nd Ed. McGraw Hill Book Co., Inc., New York, USA.

Tuffery, A.A. (1995). Laboratory animals: In: A.A. Tuffery (ed.).*An introduction for Tangtaweawipat experiments.* John Willey and Sons Ltd, England.

Wuthi-udomler, M., Grisanapan, W., Luanratana, O. and Caichompoo, W. (2000). Antifungal activity of *Curcuma longa* grown in Thailand. *Southeast Asian J. Trop. Med. Public Health,* 31 Suppl. 1:178-82.