MEDWIN PUBLISHERS
Committed to Create Value for Researchers

Bioinformatics & Proteomics Open Access Journal
ISSN: 2642-6129

Effects of Turmeric Oil as a Dietary Supplements on the Hematology and Serum Biochemical Indices of Broiler Chickens

Oluwafemi RA[1]*, Uankhoba IP[1] and Alagbe JO[2]

[1]Department of Animal Science, University of Abuja, Nigeria

[2]Department of Animal Nutrition and Biochemistry, Sumitra Research Institute, India

***Corresponding author:** Alagbe JO, Department of Animal Nutrition and Biochemistry, Sumitra Research Institute, India, Email: sumitra@finmail.com; oluwafemi-adebisi@uniabuja.edu.ng

Research Article

Volume 5 Issue 1

Received Date: June 05, 2021

Published Date: July 22, 2021

Abstract

The objective of this current study was to examine the effects of turmeric oil as a dietary supplement on some haematological and serum biochemical indices of broiler chicken. A total of two hundred 1-day-old broiler chicks (Ross 308 strain) were randomly distributed to five treatments of 4 replicates consisting of 10 birds each in a completely randomized design. Birds in treatment 1 (T1) were fed basal diet + 0% turmeric oil (TOL), T2, T3, T4 and T5 were fed basal diet supplemented with TOL at 0.1%, 0.2%, 0.3% and 0.4% respectively. Basal diet was formulated to meet the nutritional requirements of birds according to NRC (1994). Clean feed and water were also provided *ad libitum* throughout the experiment which lasted for 56 days. Results obtained showed that all the haematological parameters (Pack cell volume, haemoglobin, red blood cell, mean corpuscular volume, mean corpuscular heamoglobin, mean corpuscular haemoglobin concentration, white blood cells and its differentials) were significantly ($P<0.05$) different among the treatments. Serum biochemical parameters (Total protein, albumin, globulin, cholesterol, alanine transaminase, aspartate transaminase) were influenced by the dietary supplementation of TOL ($P<0.05$). Cholesterol level decreases as the dietary supplementation of TOL increases ($P<0.05$). However, all values were within the normal physiological range for birds. It was concluded that TOL contains several bioactive chemicals which confers it the ability to perform multiple biological functions.

Keywords: Broiler Chickens; Turmeric Oil; Haematology; Serum Biochemistry

Abbreviations: EDTA: Ethylene Diamine Tetra Acetic Acid; PCV: Pack Cell Volume; RBC: Red Blood Cell; Hb: Haemoglobin; MCH: Mean Corpuscular Haemoglobin; MCHC: Mean Corpuscular Haemoglobin Concentration; MCV: Mean Corpuscular Volume; WBC: White Blood Cell; ALT: Alanine Transaminase; AST: Aspartate Transaminase

Introduction

The increasing pressure of reducing the use of antibiotics as antimicrobial growth promoters for animals due to harmful residual toxicity effects of drugs observed in the food chain calls for alternative solutions to sustain the efficiency of current livestock production Mahima A, et al. [1]; Oluwafemi RA, et al. [2]. Among the potential alternatives is essential oil which has been found to be loaded with several bioactive chemicals, less toxic and free from residues Alagbe JO, et al. [3]. According to Franz C, et al. [4] essential oils are complex mixtures of volatile compounds produced by living organisms and isolated by physical means only (pressing and distillation) from the whole plant or plant part of known taxonomic origin. The composition of essential oil in plants depends on plant species and its age, harvesting periods, methods of processing, geographical location and soil types [5-7].

Scientific reports showed that essential oils (EOs) can perform several biological activities such as antibacterial, anti-inflammatory, cytotoxic, hypolipidemic, hepatoprotective, antiviral, miracicidal and antioxidant [8-10]. EOs are relatively cheap, effective, safe and perceived as growth promoters in poultry diets Zhang Y, et al. [11] improve meat quality Wenk C, et al. [12]; Alagbe JO, et al. [13], alteration of lymphocyte distribution in the gut Purchiaroni F, et al. [14]; Oluwafemi RA, et al. [15], potentiate the immune response [16,17], and high antimicrobial activity against pathogenic bacteria [18,19].

In view of these abundant potentials in EOs, this study was designed to evaluate the effect of dietary supplementation of turmeric oil on the haematology and serum biochemical indices of broiler chickens. This experiment will further help to bridge the gap between food safety and livestock production.

Materials and methods

Site of the Experiment

The experiment was carried out at the University of Abuja Teaching and Research Farm, Animal Science Section, Main Campus, along Airport Road, Gwagwalada, and Abuja, Nigeria.

Extraction of Turmeric Oil (TOL)

Fresh turmeric rhizome was purchased from an open market in Gwagwalada, Abuja. The outer layer of the rhizome was peeled using a kitchen knife; it was thereafter separated and sun-dried for one week. The dried rhizome was granulated into coarse particles using a laboratory grinder. A 100 g of grinded rhizome placed onto a thimble and the thimble was put into the sohxlet extractor. N-hexane solvent was poured into three-neck- round bottom flask that is joined with the extractor and flask along with the condenser on the top to avoid any solvent losses. The whole assembly was then placed on the temperature controller heater to provide the required temperature. The temperature was measured by a thermometer that was inserted in one of the necks of the round bottom flask. After certain interval of the time the experiment was stopped and the trapped oil in the solvent was separated. The mixture of solvent and oil was separated using rotary evaporator under vacuum at temperature of 65ºC, the oil obtained after evaporation was weighed.

Experimental Animals and Management

Two hundred 1- day old (Ross 308) broiler chicks with mixed sex were used for the experiment. The birds were purchased from a commercial hatchery in Ibadan and weighed on arrival on the farm to obtain their initial body weight and thereafter weekly. A deep litter housing system was used, it was fumigated two weeks prior to the commencement of the study, and the surrounding environment was also cleaned daily to ensure proper hygiene. Birds were divided to five treatments with four replicates consisting of 10 birds in a completely randomized design. Electric brooders were used and wood shavings serve as the litter material. Daily feed intake (g) was calculated as a difference between feed offered and left-over. Vaccines were administered according to the prevailing disease condition in the environment and all other management practices were strictly adhered to throughout the experiment which lasted for 56 days.

Diet Formulation

The basal diet was formulated to meet the nutrient requirements of birds according to NRC (1994) as presented in Table 1.

Treatment 1: Basal diet + 0 % TOL
Treatment 2: Basal diet + 0.1 % TOL
Treatment 3: Basal diet + 0.2 % TOL
Treatment 4: Basal diet + 0.3 % TOL
Treatment 5: Basal diet + 0.4 % TOL

Measurements

Proximate compositions of experiment diet were determined by using official method of analysis by AOAC (2000).

Haematological and Serum Biochemical Analysis

Blood samples were collected very early in the morning from the wing vein from three (3) randomly selected birds per replicate into a 5 ml sterile syringe using 23 gauge needles and transferred into an ethylene diamine tetra acetic acid (EDTA) bottle. Haematological parameters: pack cell volume (PCV), red blood cell (RBC), haemoglobin (Hb), mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC), mean corpuscular volume (MCV), white blood cell (WBC) and its differentials were analyzed using an automated machine (Sysmex, Model KU-30 HG, India).

Serum analysis was carried out using bottles free from EDTA, blood were analyzed for total protein, albumin, globulin, cholesterol, alanine transaminase (ALT) and aspartate transaminase (AST) were assayed using diagnostic kit manufactured by Merck India Ltd (Model PS-09R)

Statistical Analysis

All data were subjected to one -way analysis of variance (ANOVA) using SPSS (23.0) and significant means were

separated using Duncan multiple range tests (Duncan, 1955). Significant was declared if P ≤ 0.05.

Results and Discussions

Ingredients	Starter mash (0-4 weeks)	Finisher mash (5-8 weeks)
Maize	52	60
Soya meal	38.6	30.1
Groundnut cake	3	4
Fish meal (72%)	1	-
Bone meal	3	3
Limestone	1.5	2
Lysine	0.15	0.15
Methionine	0.2	0.2
Toxin binder	0.01	0.01
*Premix	0.25	0.25
Salt	0.3	0.3
Total	100	100
Determined analysis (% DM)		
Crude protein	23.23	20.91
Crude fibre	3.14	4
Ether extract	5.01	4.74
Calcium	1.28	1.31
Phosphorus	0.63	0.68
Energy	2901.9	3100.7

Table 1: Percentage composition of experimental diet.
*Premix supplied per kg diet :- Vit A, 10,000 I.U; Vit E, 5mg; Vit D3, 3000I.U, Vit K, 3mg; Vit B2, 5.5mg; Niacin, 25mg ; Vit B12, 16mg ; Choline chloride, 120mg ; Mn, 5.2mg ; Zn, 25mg ; Cu, 2.6g ; Folic acid, 2mg ; Fe, 5g ; Pantothenic acid, 10mg ; Biotin, 30.5g ; Antioxidant, 56mg.

Haematological Parameters of Broiler Chicken Fed Diet Supplemented with Turmeric Oil

Table 2 reveals the haematological parameters of broiler chicken fed turmeric oil (TOL). PCV, Hb, RBC, MCV, MCH and MCHC ranged between 30.10-38.96 %, 9.88-13.80 g/dl, 2.01-3.95 (10^6/µL), 101.2-149.8 fl, 32.77-49.15pg and 30.49-35.53 % respectively. Highest value were recorded in T4 and T5, intermediate in T2, T3 and lowest in T1 (P<0.05). The PCV, Hb, RBC and WBC values increased as the level of turmeric oil increases in the diets of the animals (P<0.05). This result is in agreement with the findings of Gerardo, et al. who noted that administration of Mexican oregano oil at 0.4g/kg showed positive haematological activities in broiler chicks. Similar recommendation was made by Grace FR, et al. [20] who reported a significant difference (P<0.05) in broilers fed herbal essential oil as a phytoadditive. This effect could be attributed to the presence of bioactive chemicals or secondary metabolites in turmeric oil. However, all the values of the haematological parameters fall within the ranges for broilers as reported by Talebi A, et al. [21]. Hematological studies have been found useful for disease prognosis and for therapeutic and stress monitoring but can vary due to age, gender, environment, infection and poisoning Abdi Hachesoo B, et al. [22]. Red blood cell is involved in the transport of oxygen and carbon dioxide in the body Isaac LJ, et al. [23]. This is a clear indication that birds in T5 will have a have enough oxygen especially in situation of oxygen starvation. Nse Abasi NE, et al. [24]; Subhadarsini M, et al. [25], reported that hematocrit or PCV is an index of toxicity; lower value could be a sign of anemia.

WBC, leucocytes, monocytes, heterophils, basophils and eosinophils values ranged between 19.89-30.22 (10^3/µL),

14.18-18.22%, 0.99-1.44%, 5.09-7.58%, 1.04-2.90% and 1.03-1.74% respectively. Significant differences (P<0.05) were observed among the treatments, WBC helps to fight against infections and provide resistance against diseases. This is an indication that birds in T4 and T5 have high resistance to infections which amounts to low mortality and healthy stocks. Basophils and eosinophils play a role in regulating allergic and inflammatory processes and host defense responses against parasitic infections like helminthiasis and ectoparasitic infestation Alagbe JO, et al. [26].

Parameters	T1	T2	T3	T4	T5	SEM
PCV (%)	30.10^{c}	35.43^{b}	35.56^{b}	38.71^{a}	38.96^{a}	0.03
Hb (g/dl)	9.88^{c}	11.01^{c}	12.06^{b}	13.71^{b}	13.80^{a}	0.09
RBC ×10^{6}/µL	2.01^{c}	3.61^{b}	3.68^{b}	3.71^{a}	3.95^{a}	0.1
MCV (fl)	149.8^{a}	103.7^{c}	107.5^{b}	107.0^{b}	101.2^{c}	0.18
MCH (pg)	49.15^{a}	30.50^{c}	32.77^{c}	36.95^{b}	34.94^{b}	2.33
MCHC (%)	32.82^{c}	29.41^{b}	30.49^{b}	35.53^{a}	33.51^{a}	3.09
WBC ×10^{3}/µL	19.89^{c}	22.56^{b}	25.35^{b}	28.05^{a}	30.22^{a}	1.25
Lymphocytes %	14.18^{c}	15.90^{c}	16.56^{b}	17.08^{a}	18.22^{a}	0.21
Monocytes %	0.99^{c}	1.44^{b}	1.33^{b}	1.35^{b}	1.38^{a}	0.07
Heterophils %	5.09^{c}	6.06^{b}	6.17^{c}	6.45^{b}	7.58^{a}	0.12
Basophils %	1.04^{c}	2.10^{c}	2.17^{b}	2.23^{b}	2.90^{a}	0.09
Eosinophils %	1.03^{c}	1.41^{b}	1.51^{a}	1.58^{a}	1.74^{a}	0.01

Table 2: Haematological parameters of broiler chicken fed diet supplemented with turmeric oil.
^{abc} Means different superscript along rows differs significantly at P<0.05
PCV: pack cell volume; Hb: haemoglobin; MCV: mean corpuscular volume; MCH: mean corpuscular haemoglobin; MCHC: mean corpuscular haemoglobin concentration.

Serum Biochemical Indices of Broiler Chicks Fed Diets Supplemented with Turmeric Oil (TOL)

Table 3 reveals the serum biochemical indices of broiler chicks fed diets supplemented with TOL. The total protein, albumin, globulin, cholesterol, ALT and AST values ranged between 3.45-4.95g/dl, 1.83-2.95g/dl, 1.62-2.00g/dl, 35.1-78.1mg/l, 48.10-83.19iu/L and 85.10-103.2iu/L respectively. All the values were significantly affected (P<0.05) by the dietary supplementation of TOL. The total protein in the serum of animals are influenced by protein quality in the diet, this showed that the protein levels in the diet was enough to support normal protein reserves across the treatments [27-29]. However, the values obtained in this study were within the normal ranges for broilers reported by Livingston ML, et al. [30]; Obiakaonu HO, et al. [31]. Cholesterol level decreased as the level of turmeric increased in the diet of the animal, this is a clear indication that TOL could perform hypolipidemic activity, thus preventing cardiovascular infection [3]. Alanine transaminase (ALT) and aspartate transaminase were depressed as the level of TOL increased indicating no toxicity [32-37].

Parameters	T1	T2	T3	T4	T5	SEM
Total protein (g/dl)	3.45^{b}	4.61^{a}	4.70^{a}	4.65^{a}	4.95^{a}	0.98
Albumin (g/dl)	1.83^{b}	2.87^{a}	2.70^{a}	2.85^{a}	2.95^{a}	0.02
Globulin (g/dl)	1.62^{b}	1.74^{b}	2.00^{a}	2.00^{a}	2.00^{a}	0.31
Cholesterol (mg/l)	78.1^{a}	48.3^{b}	45.1^{b}	38.3^{b}	35.1^{b}	2.33
ALT (iu/L)	83.19^{a}	50.61^{b}	50.10^{b}	49.41^{b}	48.10^{b}	4.12
AST (iu/L)	103.2^{a}	97.40^{b}	90.31^{b}	88.17^{c}	85.10^{c}	2.78

Table 3: Serum biochemical indices of broiler chicks fed diets supplemented with TOL.
^{abc} means different superscript along rows differs significantly at P<0.05
ALT: Alanine transaminase; AST: Aspartate transaminase

Conclusion

It was concluded that turmeric oil has a great potential and can be generally considered natural, less toxic due to the presence of various secondary metabolites and can be supplemented in the diet of broilers up to 0.4 % without causing any deleterious effect on the health and general performance of broiler chicks.

References

1. Mahima A, Rahal R, Deb SK, Latheef HA (2012) Immunomodulatory and therapeutic potentials of herbal, traditional and ethnoveterinary medicines. Pak J Biol Sci 15(16): 754-774.

2. Oluwafemi RA, Oluwayinka EO, Alagbe JO (2020) Effect of dietary supplementation of neem oil (*Azadirachtia indica*) on the growth performance and nutrient digestibility of weaned rabbits. European Journal of Biotechnology and Bioscience 8(5): 6-10.

3. Alagbe JO (2021) *Daniellia oliveri* leaf extracts as an alternative to antibiotic feed additives in broiler chicken diets: meat quality and fatty acid composition. International Journal of Clinical and Medical Informatics 4(1): 15-24.

4. Franz C, Novak J (2009) Sources of essential oils. *In:* Baser KHC, et al. (Eds.), Handbook of essential oils: science, technology, and applications. Boca Raton: CRC Press/Taylor & Francis Group pp: e3982.

5. Bouhaddouda N, Aouadi S, Labiod R (2016) Evaluation of chemical composition and biological activities of essential oil and methanolic extract of *Origanum vulgare* L. *ssp. glandulosum* (Desf.) *Ietswaart* from Algeria. Int J Pharmacognosy Phytochem Res 8(1): 104-112.

6. Oke F, Aslim B, Ozturk S, Altundag S (2009) Essential oil composition, antimicrobial and antioxidant activities of *Satureja cuneifolia* ten. Food Chem 112(4): 874-879.

7. Hammer KA, Carson CF (2011) Antibacterial and antifungal activities of essential oils. *In:* Thormar H, et al. (Eds.), Lipids and essential oils as antimicrobial agents.

8. Kim J, Marshall MR, Wei C (1995) Antibacterial activity of some essential oil components against five foodborne pathogens. J Agric Food Chem 43(11): 2839-2845.

9. Kommera SK, Mateo RD, Neher FJ, Kim SW (2006) Phytobiotics and organic acids as potential alternatives to the use of antibiotics in nursery pig diets. Asian-Australas J Anim Sci 19(12).

10. Giannenas I, Bonos E, Christaki E, Paneri PF (2013) Essential oils and their applications in animal nutrition. Med Aromat Plants.

11. Zhang Y, Gong J, Yu H, Guo Q, Defelice C, et al. (2014) Alginate-whey protein dry powder optimized for target delivery of essential oils to the intestine of chickens. Poult Sci 93(10): 2514-2525.

12. Wenk C (2003) Herbs and botanicals as feed additives in monogastric animals. Asian- Australas J Anim Sci 16(2): 282-289.

13. Alagbe JO, Agubosi OCP, Ajagbe AD, Shittu MD, Akintayo Balogun OM (2020) Performance, haematology and serum biochemical parameters of growing grass cutters fed *Phyllantus amarus* and *Piliostigma thonningii* leaf meal mixture as partial replacement for Soya bean meal. United International Journal for Research and Technology 2(1): 14-23.

14. Purchiaroni F, Tortora A, Gabrielli M, Bertucci F, Gigante G, et al. (2013) The role of intestinal microbiota and the immune system. Eur J Rev Med Pharmacol Sci 17(3).

15. Oluwafemi RA, Egwuiyi GN, Alagbe JO (2020) Effect of feeding *Polylathia longifolia* leaf meal as partial replacement of wheat offal. European Journal of Agricultural and Rural Education 1(1): 8-16.

16. (2000) Association of Official Analytical Chemistry. Official Method of Analysis, 15th (Edn.), Washington D.C., USA.

17. (1994) Nutrient Requirements of Swine. 11th (Edn.), National Research Council, National Academy of Science. National Academy Press, Washington, DC.

18. Franz C, Baser KHC, Windisch W (2010) Essential oils and aromatic plants in animal feeding-a European perspective A review. Flavour Fragr 25(5): 327-340.

19. Olafadehan OA, Oluwafemi RA, Alagbe JO (2020) Carcass quality, nutrient retention and caeca microbial population of broiler chicks administered Rolfe (*Daniellia oliveri*) leaf extract as an antibiotic alternative. Journal of Drug Discovery 14(33): 146-154.

20. Alagbe JO, Grace FR (2019) Effect of *Albizia lebbeck* seed oil dietary supplementation on the haematological and serum biochemical parameters of weaner rabbits. Sumerianz Journal of Agriculture and Veterinary 2(10): 96-100.

21. Talebi A, Asri Rezaei S, Rozeh Chai R, Sahraei R (2005) Comparative studies on haematological values of broiler strains (Ross, Cobb, Arbo-acres and Arian). International

Journal of Poultry Science 4(8): 573-579.

22. Abdi Hachesoo B, Talebi A, Asri Rezaei S (2011) Comparative study on blood profile of indigenous and Ross-308 broiler breeders. Global Veterinary Journal 7(3): 238-241.

23. Isaac LJ, Abah G, Akpan B, Ekaette IU (2013) Haematological properties of different breeds and sexes of rabbits. Proceedings of the 18th Annual Conference of Animal Science Association of Nigeria, pp: 24-27.

24. Nse Abasi NE, Mary EW, Uduak A, Edem EAO (2014) Haematological parameters and factors affecting their values. Journal of Agricultural Science 2(1): 37-47.

25. Subhadarsini M, Silpa MG (2020) Comparative hematology and biochemical parameters of Indigenous broiler chicken. International Journal of Scientific Technology Research 9(4): 972-978.

26. Alagbe JO (2020) Performance, hematology and serum biochemical parameters of weaner rabbits fed different levels of fermented *Lagenaria brevifora* whole fruit extract. Advances in Research and Reviews 1: 5.

27. OIabanji RO, Farinu GO, Akinlade JA, Ojebiyi OO, Odunsi AA, et al. (2007) Studies on Haematological and Serum Biochemical Characteristics of Weaner Rabbits Fed Different Levels of Wild Sunflower (*Tithonia diversifolia* Hemsl A. Gray) Leaf- Blood Meal Mixture. International Journal of Applied Agriculture and Apiculture Research 4 (1-2): 80-89.

28. Alagbe JO, Sharma D, Xing L (2019) Effect of aqueous *Piliostigma thonningii* leaf extracts on the haematological and serum biochemical indices of broiler chicken. Noble International Journal of Agriculture and Food Technology 1(2): 62-69.

29. Adewale AO, Alagbe JO, Adeoye, Adekemi G (2021) Dietary Supplementation of Rauvolfia Vomitoria Root Extract as a Phytogenic Feed Additive in Growing Rabbit Diets: Haematology and Serum Biochemical Indices. Scopia International Journal for Science, Commerce and Arts 1(3): 16-27.

30. Livingston ML, Cowieson AJ, Crespo R, Hoang V, Nogal B, et al. (2020) Effect of broiler genetics, age and gender on performance and blood chemistry. Heliyon 6(7): e04400.

31. Obiakaonu HO, Okoli IC, Opara MN, Okoro VMO, Ogbuewu IP, et al. (2011) Haematological and serum biochemical indices of starter broilers fed neem leaf meal. Online Journal of Animal and Feed Research 1(4): 150-154.

32. Musa B, Alagbe JO, Adegbite MB, Omokore EA (2020) Growth performance, caeca microbial population and immune response of broiler chicks fed aqueous extract of *Balanites aegyptiaca* and *Alchornea cordifolia* stem bark mixture. United Journal for Research and Technology 2(2): 13-21.

33. Oluwafemi RA, Akinbisola SA, Alagbe JO (2020) Nutritional and growth performance of feeding *Polylathia longifolia* Leaf Meal as partial replacement of Wheat Offal in the diet of broiler chicks. European Journal of Biotechnology and Bioscience 8(4): 17-21.

34. Singh AS, Alagbe JO, Sharma S, Oluwafemi RA, Agubosi OCP (2021) Effect of dietary supplementation of melon (*Citrallus lanatus*) seed oil on the growth performance and antioxidant status of growing rabbits. International Journal of Orange Technologies 1(2): 134-143.

35. Oluwafemi RA, Olawale AI, Alagbe JO (2020) Recent trends in the utilization of medicinal plants as growth promoters in poultry nutrition- A review. Research in: Agricultural and Veterinary Sciences 4(1): 5-11.

36. Alagbe JO (2019) Haematology, serum biochemistry, relative organ weight and bacteria count of broiler chicken given different levels of *Luffa aegyptiaca* leaf extracts. International Journal of Advanced Biological and Biomedical Research 7(4): 382-392.

37. Alagbe JO, Balogun OMA (2020) Effects of dietary supplementation of *Albizia lebbeck* seed oil (ALO) on the fatty acid composition of weaner rabbits. Biochemistry and Biotechnology Research 8(2): 29-33.