Ginger-Turmeric Fed Containing Formulated Ration on Broiler Performance and Haematology Characteristics

[1]OKATA, U. E. and [1]ANYANWUOCHA, M. C.

[1]Department of Animal Health and Production Technology, School of Agriculture and Agricultural Technology, Federal Polytechnic Nekede, Owerri, Imo State: Corresponding Author: uokata@fpno.edu.ng;

Abstract

This study was conducted to investigate the influence of dietary inclusion of turmeric and ginger on performance and on hematology characteristics of broiler chicken at eight weeks of age, under the following parameters; feed conversion ratio (FCR), average daily gain (ADG), daily feed intake (DFI) and hematology parameters; Red blood cell (RBC), white blood cell (WBC), Hemoglobin estimate (Hb), Packed Cell Volume (PVC), Mean corpuscular volume (MCV), Mean corpuscular hemoglobin (MCH) and Mean corpuscular hemoglobin concentration (MCHC). The broiler breed used for this study was a total of seventy five (75) day old broiler of ROSS 308, which was housed in a brooder for four (4) weeks where they received equal treatment, then randomly distributed into three (3) treatments coded T1, T2, and T3 and each treatment was further replicated into 3 replicates where 8 broilers were assigned to each replicate randomly, then feed and water were provided ad - libitum. Treatments were T1 (control), T2 (0.25% turmeric + 0.75% ginger), and T3 (0.75% turmeric + 0.25% ginger). ADG ranged from 27.52–37.29 g/d, comparable to Sanusi et al. (2015; 26.73–43.76 g/d), with T2 > T3 > T1 (lowest: 27.52 g/d). DFI ranged from 57.63–68.24 g/d; T1 was lowest and similar to T3 (P > 0.05) but differed from T2 (P < 0.05). FCR (1.65–2.09) was unaffected by treatment (P > 0.05), lowest in T2. On hematological indices observed were within normal reference range except mean value of WBC and higher than the reference range and its mean value range (37.967 – 46.133) 10^9/l. Since significant difference (p<0.05) was not observed among the means except RBC mean value of T1 was significantly similar to T2 but were significantly different from T3 also mean value of PCV T1 and T3 were significantly similar but differ and higher in T2 this may indicate 0.75% ginger level of inclusion against 0.25% inclusion level of ginger in T3 also among the mean value of the parameters T2 recorded higher value than any other parameter except MCH, MCHC and Lymphocyte that recorded higher mean value than T2. The experimental design used was the completely randomized design (CRD). Poultry farmers should incorporate a dietary blend of 0.25% turmeric and 0.75% ginger powder (T2 treatment) in broiler rations to optimize average daily gain (ADG) and feed conversion ratio (FCR), as it yielded the highest performance without negatively impacting feed intake or hematological profiles.

Keywords: Broilers, Ginger-Turmeric, Hematological Parameters

Introduction

Broiler production has expanded dramatically over the past two decades, primarily owing to extensive research and selective breeding programs that have enhanced feed utilization efficiency, growth rates, and mortality reduction. Feed constitutes the predominant cost component in poultry farming, accounting for 70–80% of total expenses (Daramola et al., 2020; Doma et al., 2001; Uchegbu et al., 2007). Poultry feeds comprise clusters of nutrient and non-nutrient elements, including antibiotics (Daramola et al., 2020), which augment feed conversion efficiency and mitigate elevated feed costs. Antibiotics have been extensively employed as growth promoters, administered via feed or water to stimulate appetite, suppress pathogenic bacteria, and avert diseases

(Dono, 2014). Nevertheless, their drawbacks are significant, including tissue residues in birds that, upon human consumption, foster antimicrobial resistance (Manyi-Loh et al., 2018). Antibiotic use in poultry and broader livestock production is now prohibited owing to the emergence of drug-resistant microflora (Casewell et al., 2003), with natural growth promoters advocated as viable alternatives (Aarestrup et al., 2000). Historically, plants have served as a primary source of novel medicinal compounds, making substantial contributions to both human and livestock health. Natural products represent a key reservoir for innovative therapeutics, and their application as alternative remedies for diverse diseases has surged in recent decades (Denli et al., 2003). Relative to laboratory-synthesized pharmaceuticals, herbal remedies exhibit fewer

adverse effects, lower costs, superior livestock tolerance, and greater accessibility. Prominent among these are ginger (Zingiber officinale) and turmeric (Curcuma longa), rhizomatous perennials of the Zingiberaceae family cultivated in tropical and subtropical regions worldwide (Ogwuewu et al., 2014). Turmeric harbors three principal curcumin analogues—5% bis-demethoxycurcumin, 18% demethoxycurcumin, and 77% diferuloylmethane (Daramola et al., 2020)—derived from its fresh rhizomes. These rhizomes yield commercially valuable spices that are nutritionally dense and confer health benefits, notably through modulation of blood parameters that yield critical insights into animal physiology (Kokore et al., 2021). Furthermore, their nutrient profiles, coupled with potent antioxidant, antimicrobial, and anti-inflammatory properties, establish them as efficacious natural growth promoters (Gadde et al., 2017).

The use of antibiotics drugs as growth promoters in broiler production leaves residues that affect the body system of humans that consume such birds by building up resistance to certain drugs that perform similar function as the antibiotics. There is need to replace these antibiotics with natural growth promoter by reducing microbial loads that affect the utilization of feeds consumed and increased appetite in broiler production where turmeric and ginger are useful due to their phytochemical properties as an antibiotics, antimicrobials and natural growth promoter.

Materials and Method: Experimental Location and Duration: The experiment was carried out at the poultry unit of the department of Animal Health and Production Technology Teaching and Research farm, Federal polytechnic Nekede, Owerri, Imo State. The research study last for 8 weeks with preparation of treatment material (ginger and Turmeric).

Experimental Ration: Experimental diets for this experiment were self-compounded broiler finisher produced at the departmental research farm. Rhizomes of these plants are dried and milled to obtain ginger and turmeric powder (Daramola *et al.,* 2020) used as additives in the feed. The chicks were fed on 3 dietary treatments. T1 control treatment (has no ginger and turmeric), T2 (0.75% ginger and 0.25% turmeric), T3 (0.25% ginger with 0.75% turmeric). The experimental diet was given ad libitum for 4 weeks by daily weighing of feed before given to experimental birds and weigh again the following day to determine daily feed intake for each treatment per replicate and weekly body weight was taken to get feed efficiency. Table 1.0 shows the experimental diet

Experimental Chicks: A total of 75 newly hatched (day old) unsexed broiler chicks of ROSS 308 breed were procured from a reliable hatchery and transported to the research farm Animal Health and Production Technology, Federal Polytechnic Nekede Owerri, Imo State. Electrolyte was given to the chicks immediately after stocking to ease transportation stress. The experimental chicks received equal treatments in the brooder house and fed ad libitum till four weeks of age. The birds were weighed and randomly distributed after 4 weeks of brooding into three (3) treatments and each treatment was replicated into 3 with 8 broilers in each replicate in a completely randomized design (CRD).

Experimental Design: The experimental design is completely randomized design (CRD) statistical model is given below:

$X_{ij} = m + T_i + \sum ij$

Where X_{ij} = individual observation

M = Overall mean

T_i = effect of the treatment. Where i = 1, 2, 3.........

$\sum ij$ = experimental

Data Collection: Performance Parameters: Weekly body weight and daily feed intake were taken for each treatment per replicate to determine the weight gain and feed conversion ratio. The parameters data were subjected to statistical tool using SPSS, computer software (SPSS, 2023). Differences between means were separated using Duncan's New Multiple Range Test (DNMRT).

Haematological Characteristics: Blood samples collection was done in the morning after the birds were starved overnight in order to attain a stable hematological and antioxidant evaluations at 8th week of their age, two (2) birds were randomly chosen from each treatment making sum of 6 birds. Prior to sample collection, the birds were gently restrained in lateral recumbency. The portal vein or brachial wing vein, located under the wing between the biceps and triceps muscles and running parallel to the humerus, was identified and disinfected with a 70 % isopropyl alcohol swab (Onunkwo *et al*., 2022). Using a sterile 5ml disposable syringe at a 20° angle, 3 ml of blood was collected from each bird and immediately transferred into sample bottles well labeled containing ethylene diamine tetra-acetic acid (EDTA) for hematology analysis (Onunkwo *et al*., 2022). The blood samples were sent to laboratory for analysis were determined according to Lambs (1981). Haematological parameters measured include packed cell volume (PCV), red blood cell (RBC), white blood cell WBC), haemoglobin (Hb), mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC). The parameters data were subjected to statistical tool using SPSS, computer software (SPSS, 2023). Differences between means were separated using Duncan's New Multiple Range Test (DNMRT).

Overall Performance of Broilers Fed with Turmeric-Ginger Results and Discussion: The overall performance of broiler birds fed with experimental diets, were shown in (Table 2.0), the average daily gain (ADG) range from (27.5198 - 37.2873)g/d this mean values were comparable to the earlier of (Sanusi *et al.,* 2015) which ranged from (26.73 – 43.76)g/d, on this present study T2 recorded the highest mean value this may indicate 0.75% ginger level of inclusion against 0.25% inclusion level of ginger that causes optimal

utilization of feed through good digestion followed by T3 and T1 recorded the least value on ADG (27.5198g/d) which was a reflect on daily feed intake (DFI) where T1 recorded the lowest mean value which was similar with earlier report of (Sanusi *et al*., 2015). Daily feed intake (DFI) ranged from 57.6275 - 68.2438 with the least value recorded by T1 on feed intake were significantly similar with T3 but significant different with T2 while feed conversion ratio (FCR) was not significantly influenced by the treatments and its value ranged from 1.6470 - 2.0930 with least mean value recorded by broilers fed with T2 and this mean value was similar with earlier report of (Sanusi *et al*., 2015). T2 and T3 were significantly similar but significantly different from control diet T1. T2 performed better in converting the feed to a unit muscle deposition followed by broilers fed T3 while T1 recorded the highest value in FCR which performed poorly when compared to other treatments T2 and T3.

Haematology Profile: Results of the dietary inclusion of ginger and turmeric on the hematology of broiler chicken is presented on table 3.0. Mean values of hematological indices observed were within normal reference range except mean value of WBC and higher than the range of value (37.967 – 46.133) 10^9/l. Since significant difference (p<0.05) was not observed among the means except RBC mean value of T1 was significantly similar to T2 but were significantly different from T3 also mean value of PCV T1 and T3 were significantly similar but differ and higher in T2 this may indicate 0.75% ginger level of inclusion against 0.25% inclusion level of ginger in T3 also among the mean value of the parameters T2 recorded higher value than T1 and T3 except in MCH, MCHC and Lymphocyte that T3 recorded higher mean value than T2. RBC Mean values of T1 and T3 were similar with earlier report of (Kokore *et al*., 2021) (Sanusi *et al*., 2015) also HB mean value of T3 was similar to earlier report of (Kokore *et al*., 2021) but the mean values of PCV across the treatments were seminal to (Irivboje and Olufayo, 2023) with mean values (21 – 34.5) and higher than values of (Kokore *et al*., 2021) but were within the RR, also mean values of MCV across the treatments were lower than values of (Kokore *et al*., 2021). HB, PCV and Lymphocytes Mean values were higher across treatments than (Daramola *et al*., 2020) values but were within RR values.

Conclusion and Recommendations: Result from this research, showed that birds in T2 performed better in converting the feed to a unit muscle deposition followed by broilers fed T3 while T1 recorded the highest value in FCR which performed poorly when compared to other treatments T2 and T3. Mean values of hematological indices observed in this study were within normal reference range except mean value of WBC and higher than the range of value (37.967 – 46.133) 10^9/l. T2 recorded higher mean value in hematological indices than T1 and T3 except in MCH, MCHC and Lymphocyte that T3 recorded higher mean value than T2. Based on results obtained from this study, it can be concluded that the use of ginger-turmeric formulated broiler finisher diet at ratio of (0.75:0.25) % in T2 resulted in better performance than T1 and T3 may be due to better digestion and utilization of feed. Poultry farmers should incorporate a dietary blend of 0.25% turmeric and 0.75% ginger powder (T2 treatment) in broiler rations to optimize average daily

gain (ADG) and feed conversion ratio (FCR), as it yielded the highest performance without negatively impacting feed intake or hematological profiles. Future studies should test higher or varied combinations of turmeric and ginger levels (e.g., 0.5% each or sequential inclusions) across longer growth phases beyond 8 weeks to confirm sustained benefits on growth performance and immunity, given the elevated WBC counts observed. Researchers are advised to expand hematological assessments to include differential leukocyte counts and serum biochemistry (e.g., antioxidants like SOD or MDA) to better elucidate the immunomodulatory effects of these phytogenics, particularly at the 0.75% ginger inclusion rate in T2

References

Aarestrup, F. M., Seyfarth, A. M., Emborg, H.-D., Pedersen, K., Hendriksen, R. S., & Bager, F. (2000). Effect of abolishment of the use of antimicrobial agents for growth promotion on occurrence of antimicrobial resistance in fecal enterococci from food animals in Denmark. Antimicrobial Agents and Chemotherapy, 44(4), 943–948. https://doi.org/10.1128/AAC.44.4.943-948.2000.

Casewell, M., Friis, C., Marco, E., McMullin, P., & Phillips, I. (2003). The European ban on growth-promoting antibiotics and emerging consequences for human and animal health. Journal of Antimicrobial Chemotherapy, 52(2), 159–165. https://doi.org/10.1093/jac/dkg313.

Daramola, G. T., Adebiyi, O. A., & Oluwafemi, R. A. (2020). Phytochemical screening and proximate analysis of turmeric (Curcuma longa) and its effect on broiler performance. Journal of Poultry Science and Technology, 12(1), 45–52.

Daramola, O. T., Jimoh, O. A. and Arire, E. O. (2020). Haematological parameters, antioxidant status and carcass analysis of broiler chickens fed diets supplemented with turmeric (Curcuma longa) Nig. J. Anim. Prod. 2020, 47(4):103 – 110.

Denli, M., Okan, F., & Celik, K. (2003). Effect of dietary probiotic, organic acid and antibiotic supplementation to diets on broiler performance and carcass yield. Proceedings of the World's Poultry Congress, 22, 156–160.

Denli, M., Oka, F. and Celik, F. 2003. Effect of dietary probiotic, organic acids and antibiotic supplemented diets on broiler performance and carcass yield. *Pakistan Journal of Nutrition* 2(2) : 89 - 99.

Doma UD, Muhammad AS, Bello KM & Ugbeh E (2001). Performance of Broilers chickens fed with local formulated fed and commercial feeds. *Nigerian Journal of Tropical Agriculture*, 3: 83-86.

Dono N. D. 2014. Turmeric (Curcuma longa Linn.) supplementation as an alternative to antibiotics in poultry diets. WARTAZOA. Indonesian Bulletin of Animal and Veterinary Sciences. 23 (1): 41-49. D O I : 1 0 : 1 4 3 3 4 / wartazoa.v23i1.958.

Gadde U, Kim WH, Oh ST, Lillehoj HS (2017). Alternatives to antibiotics for maximizing growth performance and feed efficiency in poultry: a review. *Anim Health Res Rev* 18:26– 45.

Irivboje, O. A. & Olufayo, O. O. (2023). Haematology and Serum Biochemistry of Broiler

Chicken Administered Laganaria breviflorus Extract. International Journal of Women in Technical Education and Employment ISSN: 2811-1567. Volume 4 – Issue 1. July 2023 https://fpiwitedjournal.federalpolyilaro.edu.ng.

Kokore A B, Kamagate s, Bleyere N M and Yapo A P. (2021). Hematological profile of broilers and local chickensin korhogo, Cote D'ivoire International Journal of Agriculture, Environment and Bioresearch Vol. 06, No. 02; 2021

Manyi-Loh, C.; Mamphweli, S.; Meyer, E.; Okoh, A. (2018). Antibiotic Use in Agriculture and Its Consequential Resistance in Environmental Sources: Potential Public Health Implications. Molecules 2018, 23, 795.

Ogbuewu I.P. , Jiwuba P.D., Ezeokeke C.T., Uchegbu M.C., Okoli I.C. and Iloeje M.U.
Evaluation of phytochemical and nutritional composition of ginger rhizome powder. International Journal of Agriculture and Rural Development Volume 17 (1): 1663-1670, 2014.

Onunkwo, D. N., Ufot, U. E., Ezenyilimba, B. N., Omumuabuike, J. N and Ezeoke, F. C. (2022).
Blood profile of starter broiler chickens fed diet containing leaf meal composite as alternative to commercial broiler premix. Nigerian J. Anim. Sci. 2022, 24 (2): 103-110

Uchegbu, M.C., Irechukwu, N.M., Omede, A.A., Nwaodu, C.H., Anyanwu, G.A., Okoli, I.C and Udedibie AB (2007). Comparative evaluation of three commercial feed on the performance of broilers. In Proceedings of the forty first Annual Conference of Agricultural Society of Nigeria Zaria, Nigeria, Pp 359 – 363.

Sanusi, M., Rabi, A., Doma, U.D. and J Haruna, J. (2015) Comparative effect of Self-formulated and four commercial diets on the growth performance, carcass and hematological parameters of broiler finishers in the tropics Sokoto J. Vet. Sci.. 2015; 13(2): 14-19.

SPSS Institute (2023). IBM/SPSS user's guide; statistics. Version 23. International Business Machines Corporation, USA

Table 1.0 Composition of experimental broiler finisher diets

FEEDSTUFFS	T1	T2	T3
Maize	54.00	54.00	54.00
Soybean	20.80	20.80	20.80
PKC	12.40	12.40	12.40
Wheat offal	6.50	6.50	6.50
Fish meal	3.00	3.00	3.00
Bone meal	2.00	2.00	2.00
Toxin binder	0.25	0.25	0.25
Salt	0.30	0.30	0.30
Premix	0.50	0.50	0.50
Ginger		0.75	0.25
Turmeric		0.25	0.75
Methionine	0.5	0.5	0.5
Lysine	0.5	0.5	0.5
TOTAL	100	100	100
Calculated composition			
Crude protein %	20.52	20.56	20.62
Metabolizable energy Kcal/kg	3063.05	3080.65	3088.15

Table 2.0 FED DIETS AND CONTROL DIET (SELF FORMULATED FEED)

Parameters	T1	T2	T3	SEM
ADG(g/dy)	27.5198[bc]	37.2873[a]	36.55089[a]	1.2555

DFI(g/g)	57.62759[a]	61.3925[bc] 68.2498[a]	3.7542
FCR	2.0930	1.64703 1.8683	0.0843

[abc] means with different superscripts differ significantly (p<0.05) different. SEM – means standard error of mean, ADG – Average Daily Gain, DFI - Daily Feed Intake and FCR – Feed Conversion Ratio.

Table 3.0 Effect of ginger and turmeric on hematological characteristics of broiler chicken at eight (8) weeks old.

PARAMETER	T1	T2	T3	RR
WBC(10^9/l)	38.733333	46.133333	37.966667	9 - 32
RBC(10^{12}/l)	2.953333[a]	3.153333[a]	2.716667[b]	1.25-4.50
HB (g/dl)	12.833333	13.566667	11.400000	10 -14
PCV(%)	35.766667[a]	38.000000[b]	33.366667[a]	35 -55
MCV(FL)	122.766667	123.966667	124.566667	104 -140
MCH(pg)	43.966667	43.733333	44.500000	25 - 48
MCHC(g/dl)	35.023	35.266667	35.833333	30.2-36.2
LYMPH(%)	83.000000	83.333333	85.000000	29.0-84.0

a,b =Means in the same row with different superscripts are significantly **(p< 0.05)** Erythrocyte (RBC), Lymphocyte (WBC), Hemoglobin estimate (Hb), Packed cell volume (PVC), Mean corpuscular volume (MCV), Mean corpuscular hemoglobin (MCH), Mean corpuscular hemoglobin concentration **(MCHC)**

different = Reference Range