

Influence of turmeric (*curcuma longa*) as feed additive on the performance, serum enzymes and lipid profile of broiler chickens

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Target Audience: *Researchers, Animal Nutritionist and Poultry Farmers*

Abstract

This study was conducted to investigate the effects of dietary supplementation with turmeric powder as a natural growth promoter on performance, and serum biochemical profile in broiler chickens. A total of 200 day old broiler chicks (Ross) were allocated to five dietary treatments, with four replicates, having 10 birds per replicate. The dietary treatments consisted of the control diet (T₁) with 0% turmeric powder, and then 0.25%, 0.50%, 0.75% and 1.0%??/100kg of feed with turmeric powder added to T₂, T₃, T₄, and T₅ respectively. Results showed that feed intake was not significantly influenced across the treatments (P>0.05). The average weekly weight gain and final weight of the broilers differed significantly (P<0.05) amongst the treatment groups. Turmeric supplementation showed a significant decrease in FCR and in turn improved feed efficiency. The effects of turmeric on Aspartate amino-transferase (AST), Alanine transaminase (ALT), and total cholesterol (TC) increased significantly in the group that received the highest concentration of turmeric. However, this increase is minimal to cause any observable adverse effect. Meanwhile, there was significant increase in low density lipoprotein (LDL) among the group that received 1% (100g) Turmeric/100kg feed. There were no significant increase in serum high density lipoprotein (HDL) and triglyceride. The result of this study therefore, demonstrates that dietary supplementation of turmeric powder should not exceed 1000g/kg feed in broiler production. It was also shown that turmeric addition had a positive influence on feed conversion ratio thereby improving the weight gain in broiler birds.

Keywords: *Turmeric; Performance; Serum Enzymes; Lipid Profile*

Description of Problem

Broiler production can produce very high-quality proteins for human nutrition as well as a source of income for the community in many countries, hence poultry production has very important role in economic development of any country⁽¹⁾. The demand for broiler meat is increasing rapidly, driven by increased income and population growth and urbanization⁽²⁾. Broiler production has grown dramatically in the past two decades; these improvements are largely due to numerous researches and breeding programs which further enhanced feed utilization, growth rate and high productivity⁽¹¹⁾. Feed is the key constituent of

overall costs of poultry farming, being responsible for about 80% of the total expenses⁽⁴⁾

The awareness in feed additives flourished over the last decade. Feed additives are a cluster of nutrients and non-nutrient composites which help in improving the efficiency of feed utilization and consequently dropping the high cost of feed⁽⁵⁾. These additives have established a great consideration as feed supplements for numerous purposes in poultry production throughout the recent years⁽⁶⁾. In the past, antibiotics were regularly used as feed additives⁽⁷⁾. Though, currently use of

antibiotics is not only restricted but also their practice in livestock and poultry industry have been prohibited in many countries due to modification of natural gut microbiota and drug resistance in microorganisms and humans. Natural growth promoters such as prebiotics, probiotics, symbiotics, enzymes, plant extracts, etc., can be used to feed the broilers without any adverse effect on the performance of birds⁽⁸⁾. Beneficial properties of bioactive plant constituents in animal nutrition may comprise the stimulation of appetite and feed intake, the enhancement of endogenous digestive enzyme secretion, stimulation of immune response and anti-bacterial, antiviral and antioxidant action⁽⁹⁾. Turmeric as natural growth promoter can be used as an alternative of common artificial growth promoters like antibiotics.

Turmeric rhizome (*Curcuma longa*) commonly known as turmeric, is a widely used spice, food preservative and coloring agent that has biological activities and medicinal applications and grown in Southern and South-Eastern tropical Asia⁽¹²⁾. The active ingredients found in Turmeric (*Curcuma longa*) are curcumin, desmethoxycurcumin, bisdemethoxycurcumin and tetrahydrocurcuminoids⁽¹³⁾. Curcumin is the crucial indispensable bioactive component liable for the biological action of *Curcuma longa*⁽¹⁴⁾. Traditionally, it has been used to treat various diseases/disorders e.g., liver obstruction, jaundice, ulcers, inflammation, dysentery, diabetes, stomach disorders, fresh wounds, insect stings and viral infections including chickenpox and smallpox⁽¹⁶⁾. Curcumin has also anti-inflammatory and antioxidant properties⁽¹⁵⁾. It is also used in gastrointestinal and respiratory disorders. A number of experiments have been conducted to assess curcumin effect on the performance of broiler chickens and laying hens. Their findings conclude that turmeric supplementation was

beneficial in terms of weight gain, feed utilization and hypolipidemic^{(17), (3)}.

Therefore, the purpose of this research is to investigate the effect of adding different levels of turmeric powder on growth performance, feed conversion efficiency, enzymes and lipids profile of broiler chickens.

Materials and Method

The experiment was conducted at the poultry unit, Faculty of Agriculture demonstration farm, University of Port Harcourt, Choba, Obio/Akpor Local Government Area of Rivers State. The experiment lasted for eight (8) weeks. A total of two hundred (200) Ross day-old broiler chickens were purchased from a reputable hatchery, and were properly housed in a deep litter house. Daily routine management practices as it applies to broiler rearing were carried out. The birds were assigned to five treatments, with four replicates having ten (10) birds each, in a Completely Randomized experimental design by the 14th day of brooding. The dietary treatments for the starter phase and finisher phase of the trial, are as shown on Tables 1 and 2 respectively.

Turmeric was bought from the market in the raw form, and was washed, cut into smaller pieces and sundried to reduce the moisture content. They were ground into meal and passed it through 1mm sieve to obtain a fine powder. This was added at different levels to 100 kg of feed to the different dietary treatments, as follows: Treatment 1: 0g turmeric (control); Treatment 2: 250g turmeric; Treatment 3: 500g Turmeric; Treatment 4: 750g turmeric; and Treatment5: 1000g turmeric.

Feed offered on daily basis was weighed, and left overs weighed out. Weekly weight of the birds was determined and recorded, to ascertain the weekly weight gain. Feed conversion ratio was calculated at the end of the experiment.

At the end of the experimental period, blood samples were collected from 20 birds picking 1 bird from each of the replicates, via the brachial vein with 2ml syringes. Serum samples were isolated by centrifugation. Individual serum samples were analyzed for aspartate amino transferase (AST), alanine transaminase (ALT), alkaline phosphatase (ALP), total cholesterol (TC), high-density

Lipoprotein (HDL), Low density Lipoprotein (LDL), and triglyceride, by a biochemical analyzer.

The data generated were subjected to one way Analysis of variance (ANOVA) using the SPSS package programme (SPSS version 15.0 software for windows. SPSS INC. Chicago, IL).

Table 1: Experimental Starter's Diet

INGREDIENT	CONTROL (1)	TRT 2	TRT 3	TRT 4	TRT 5
Maize	41	40.5	40	39.5	39
PKC	7.46	7.46	7.46	7.46	7.46
Soya bean meal	6.5	6.5	6.5	6.5	6.5
Groundnut cake	14	14	14	14	14
Fish meal	7.74	7.74	7.74	7.74	7.74
Wheat bran	7	7	7	7	7
Soya bean oil	3	3	3	3	3
Bone meal	3	3	3	3	3
D-L Methionine	0.5	0.5	0.5	0.5	0.5
Lysine	0.5	0.5	0.5	0.5	0.5
Vit/Min. Premix	2.5	2.5	2.5	2.5	2.5
Turmeric	0	0.25	0.5	0.75	1.0
Salt	0.3	0.3	0.3	0.3	0.3
Total	100	100	100	100	100
Calculated feed composition					
Crude Protein %	23.06	23.06	23.06	23.07	23.04
ME Kcal/kg	2805.29	2803.88	2808.47	2801.06	2803.27
Crude Fibre %	4.78	4.79	4.81	4.83	4.83
Oil %	6.5	6.5	6.5	6.5	6.5
Analyzed feed composition					
Crude Protein %	23.02	23.02	23.05	23.05	23.03
ME Kcal/kg	2821.00	2816.12	2306.26	2823.14	2806.23
Crude Fibre %	4.23	4.56	4.56	4.69	4.78
Oil %	6.06	6.06	6.06	6.06	6.06

Table 2: Experimental Finisher's Diet

INGREDIENT	CONTROL	TRT 2	TRT 3	TRT 4	TRT 5
Maize	51.50	51.25	51.00	50.75	50.50
PKC	5.00	5.00	5.00	5.00	5.00
Soya bean meal	10.00	10.00	10.00	10.00	10.00
Groundnut cake	10.00	10.00	10.00	10.00	10.00
Fish meal	7.70	7.70	7.70	7.70	7.70
Wheat bran	5.00	5.00	5.00	5.00	5.00
Soyabeanoil	4.00	4.00	4.00	4.00	4.00
Bone meal	3.00	3.00	3.00	3.00	3.00
D-L Methionine	0.50	0.50	0.50	0.50	0.50
Lysine	0.50	0.50	0.50	0.50	0.50
Vit/Min. Premix	2.50	2.50	2.50	2.5	2.50
Turmeric	0.00	0.25	0.50	0.75	1.00
Salt	0.30	0.30	0.30	0.30	0.30
Total	100	100	100	100	100
Crude Protein %	20.06	20.07	20.07	20.07	20.07
ME Kcal/kg	3007.76	3006.35	3004.94	3003.53	3002.12
Crude Fibre %	4.1	4.12	4.14	4.15	4.17
Oil %	7.57	7.57	7.57	7.58	7.58
<i>Analyzed feed composition</i>					
Crude Protein %	19.67	19.53	19.53	19.69	19.69
ME Kcal/kg	3002.98	3003.67	3003.68	3003.78	3002.59
Crude Fibre %	4.06	4.02	4.1	4.7	4.12
Oil %	7.09	7.23	7.23	7.23	7.23

Results and Discussion

From the findings of this trial, increasing turmeric inclusion rate in broilers diet did not indicate any significant difference in feed intake between the treatment groups. Similar observations were made in a study when chickens were used^(18, 17); The authors reported that, at 5g/kg level turmeric there was no significant influence in feed consumption of chicken, where as feed intake of bird supplemented with turmeric was similar to that of control group. The effect of turmeric on average weekly weight gain and final weight of broilers markedly increased in T4, and T5, though not significantly different from the Control (T1). This result contradicts with the report a Researcher⁽¹⁸⁾, who reported that at an inclusion rate of 250, 500, and 750g of diet

turmeric had no effect on weight of broilers. It was in agreement with the findings of this Researcher⁽¹⁷⁾ who reported that inclusion of turmeric at 500g of feed increased body weight of broiler birds, and concluded that, the significant increase in body weight might be due to optimum antioxidant activities of turmeric at the level of 5g/kg that stimulates protein synthesis by enzymatic system.

The feed conversion ratio of the experimental birds in T1, T2, T4, and T5, especially T5 with the lowest mean value reveals that the impact of growth promoter substance such as phytogenic products on performance could be related to a more efficient use of nutrients, which in turn resulted in an improved feed utilization efficiency. Turmeric also has the ability to

control and limit the growth and colonization of numerous pathogenic and non-pathogenic species of bacteria in birds. It was also reported that chicken receiving diet supplement with 5g/kg turmeric powder had better feed efficiency than 2.5g/kg supplementation level, which agrees with the present results on feed conversion ratio⁽¹⁷⁾. Again, another researcher⁽³⁾ showed that inclusion of turmeric at the level of 0.6g/kg diet significantly increased weight gain and improve feed conversion when compared with other treatments.

Serological surveys are useful source of information about epidemiological, nutritional parameters for infectious diseases, nutritional, reproductive, and haemostatics of the body of broiler birds. One of the ways to diagnose pathological conditions in birds is the serum enzymatic activity. Aspartate aminotransferase (AST) and Alanine Transaminase (ALT) are some of those enzymes, and they increased significantly in Treatment 5, but this increase has no negative effect on the liver, serum or muscle of broiler birds, because it has been reported that AST and ALT can only cause hepatic disorder when it is greater than 275IU/L, and when it is up to 800IU/L its indicative of severe hepatic damage⁽²¹⁾.

From the results obtained, turmeric supplementation in broilers diet significantly reduced alkaline phosphatase (ALP) in the treatment that received highest level of turmeric (T5-1000g/kg of feed). This implies that turmeric might have some positive effect

on liver enzyme that directly or indirectly reflect a healthier liver status in broiler chickens. Similarly, it was reported that the inclusion of turmeric powder in broilers diet at the level of 5g/kg, significantly decreased Serum Alkaline Phosphatase (ALP)⁽¹⁹⁾.

There is significant increase in Total Cholesterol from the result obtained, and this is similar to the report of a researcher⁽²²⁾; that turmeric supplementation into basal diet of broilers chicken increased total cholesterol significantly. It was reported that the normal range of total cholesterol in the blood of chicken is 55-195mg/dl⁽²⁰⁾. Therefore, the present report, which showed increased total cholesterol did not have any adverse effect on the health of broiler birds.

No significant effect on Triglyceride concentration and High Density Lipoprotein from the present study, which might be due to the reduction of synthetic enzymes activities. Similarly, it was reported that curcuma longa had lowering effect on triglyceride level in broilers serum which shows that turmeric has hypolipidemic action in broilers birds⁽³⁾, but contrasted with the findings of⁽¹⁹⁾ who reported that turmeric supplement into basal diet of broilers significantly increased High Density Lipoprotein. The results obtained indicates significant effect of turmeric on LDL, as the treatments that received high turmeric level (T5 – 1000g) was high in LDL than other treatments, this was in contrast to the findings of these researchers,⁽²²⁾ and⁽¹⁹⁾, who reported that turmeric decreased LDL.

Table 3: Effects of graded levels of turmeric (*Curcuma longa*) on the performance of broiler birds

Parameters	T ₁ (0%)	T ₂ (0.25%)	T ₃ (0.5%)	T ₄ (0.75%)	T ₅ (1%)
Initial. wt. (gm)	375.00 ^a ± 2.88	365.00 ^a ± 8.66	340.00 ^b ± 5.77	370.00 ^a ± 0.00	380.00 ^a ± 5.77
Final. wt. (gm)	2950.00 ^{ab} ±28.86	2700.00 ^c ± 57.73	2150.00 ^d ± 144.34	2750.00 ^{bc} ± 28.86	3050.00 ^a ± 28.86
Weekly Wt. gain. (gm)	429.18 ^{ab} ± 4.34	389.16 ^c ± 8.17	301.66 ^d ± 25.01	396.66 ^{bc} ± 4.81	445.00 ^a ± 5.77
Weekly Feed Intake (gm)	1155.00 ± 0.00	1155.00 ± 0.00	1155.00 ± 0.00	1155.00 ± 0.00	1155.00 ± 0.00
FCR.	2.69 ^b ± 0.28	2.97 ^b ± 0.63	3.91 ^a ± 0.32	2.91 ^b ± 0.34	2.59 ^b ± 0.37
Mortality.	0.75 ± 0.47	0.25 ± 0.25	1.00 ± 0.57	0.00 ± 0.00	0.25 ± 0.25

^{a,b,c,d}: Mean ± SEM in the same row with different superscripts differ significantly (P<0.05)

Table 4: The effects of turmeric (*Curcuma longa*) on serum enzymes and lipid profile of broiler chickens

Parameters	T ₁ (0%)	T ₂ (0.25%)	T ₃ (0.5%)	T ₄ (0.75%)	T ₅ (1.0%)
AST(iu/l)	85.00 ^b ±13.68	97.25 ^{ab} ±4.92	105.75 ^{ab} ±4.96	109.50 ^a ±2.02	117.50 ^a ±4.50
ALT(iu/l)	5.85 ^b ±0.72	6.43 ^b ±0.57	7.43 ^b ±1.12	10.15 ^{ab} ±1.51	12.98 ^a ±3.29
ALP(iu/l)	.75 ^a ±27.61	259.50 ^a ±29.05	342.25 ^a ±35.05	275.00 ^a ±13.84	176.50 ^b ±19.68
TC(mmol/L)	4.70 ^a ±0.23	4.53 ^{ab} ±0.24	3.60 ^b ±0.41	5.30 ^a ±0.32	4.75 ^a ±0.38
TG(mmol/l)	1.23±0.04	1.17±0.22	1.07±0.14	1.27±0.07	0.94±0.06
HDL(mmol/l)	1.35±0.07	1.61±0.14	1.39±0.09	1.44±0.15	1.38±0.21
LDL(mmol/l)	2.46 ^{bc} ±0.21	2.12 ^{bc} ±0.37	1.66 ^c ±0.27	2.87 ^{ab} ±0.28	3.52 ^a ±0.26

^{a,b,c}Mean ± SEM in the same row with different superscripts differ significantly (P<0.05)

AST=Aspartate aminotransferase, ALP= Alkaline phosphatase, TG =Triglyceride, TC= Total cholesterol
ALT=Alanin transaminase, LDL = Low density lipoprotein, HDL =High density lipoprotein,

Conclusion and Applications

1. Results from this study revealed that 1000gof turmeric /kg of feed supplementation in broiler diet enhanced feed utilization, and thereby improved weight gain and also showed no significant alteration in serum enzymes and lipid profile of broiler birds.
2. Phytogetic feed additives such as turmeric should be used in broiler diets in order to prevent deposition of toxic substances in poultry meat when synthetic antibiotics are used, which may invariably be harmful to humans when consumed.

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