Nig. J. Anim. Prod. 2017, 44(3):202 - 209
©Nigerian Society for Animal Production
Nigerian Journal of Animal Production

Evaluation of graded levels of raw and cooked turmeric rhizome (*Curcuma longa*) on performance of starter broiler chicks

Obionwu, D. C., Esonu, B. O., Etuk, E. B., Adebanjo, A. S. and Eze, B. O.
Department of Animal Science and Technology,
Federal University of Technology, Owerri, Nigeria. esonubabs@yahoo.com; babsesonu@icloud.com; esonubabs@futo.edu.ng

Abstract

This study was designed to evaluate the effect of different levels of raw and cooked turmeric rhizome (Curcuma longa) on the performance of starter broiler chicks in a complete randomised design. Turmeric rhizome was washed with water and divided into two batches of 20kg each. The first batch was crushed, then sundried for 3 days. The second batch was cooked for an hour, crushed with a roller and sundried for 3 days. Both the raw and cooked sundried turmeric rhizomes were then ground using a hammer mill to produce raw and cooked turmeric rhizome meal and were bagged respectively. Seven (7) broiler starter diets were formulated to contain raw or cooked turmeric rhizome meal at 0% (control diet), 0.5%, 1.0% and 1.5% levels, respectively. The diets were offered ad libitum to 189 Cobb broilers which were randomly divided into 7 dietary treatment groups, each containing 3 replicates of 9 birds per replicate. The experiment lasted for 21days. All the routine management practices were duly observed. Daily weight gain, daily feed intake, mortality and feed conversion ratio were used as criteria of response. The results indicated that addition of turmeric rhizome meal had no significant (p>0.05) effect on daily weight gain, daily feed intake, mortality and feed conversion ratio as compared with the control. It was evident that the different processing methods and the dietary levels used had no effect on broiler performance based on the results obtained in this study and within the circumstances of the experiments. It can be concluded that sun-dried raw and cooked turmeric rhizome meal at the dietary levels used did not significantly affect broiler starter performance.

Keywords: raw and cooked turmeric rhizome meal, broiler chicks, performance.

Introduction

The increasing human population in the tropics including Nigeria has given rise to increased demand of poultry and livestock products to satisfy animal protein need of the people. Poultry meat and eggs play very useful roles in bridging the animal protein intake gap in Nigeria. Moreover, poultry products are palatable and acceptable, this acceptability cuts across nearly all cultural and religious boundaries in Nigeria. The economic and nutritional demand of modern society for food from poultry therefore necessitates the raising of poultry under intensive production system. Under such condition, feed additives/growth promoters are often used to suppress or eliminate harmful microorganisms in the intestine and to improve growth and performance. Antibiotics are mostly used at sub therapeutic level to improve the production performance of poultry birds. However, consistent use of antibiotic will not only lead to various health issues, could be a major contributors to higher feed cost. Thus, it is imperative to sort out alternatives that could effectively and economically substitute antibiotics (Toghyani *et al.,* 2011).

Emphatically herbs and plant extracts used in animal feed are referred to as phytogenic feed additives (PFA), and are defined as compounds of plant origin incorporated into animal feed to enhance livestock productivity through the improvement of digestibility, nutrient absorption and

elimination of pathogens resident in the animal gut (Kamel, 2001; Balunas and Kinghorn, 2005, Athanasiadou *et al.,* 2007). Herbs and spices are currently in use in livestock production because of their positive properties including anti-inflammatory, antiseptic, sedative, and anti-fungal activities, the stimulation of appetite and feed intake, the improvement of endogenous digestive enzyme secretion, activation of immune responses and antibacterial, antiviral, and antioxidant actions (Toghyani *et al.,* 2010, 2011). A variety of these herbs and spices including turmeric have been widely used as alternatives to synthetic antimicrobial growth promoter in livestock and poultry production.

Turmeric (*Curcuma longa*) is one of such spices used mainly for their nutritional and medicinal potentials. Turmeric spice which is a rhizomatous herbaceous perennial plant of the Zingiberaceae family has the native origin to be the South Eastern India. Turmeric is a highly branched yellow to orange cylindrical aromatic rhizome with brown skin. The leaves are alternate and arranged in rows. They are divided into two leaf sheath; petiole (50-115cm long) and leaf blade (76-115cm long).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 and bisdemethoxycurcumin (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 (Osawa *et al.,* 1995). Turmeric has been reported to have antimicrobial, antioxidative and medicinal properties (Holt *et al*, 1999). It has been used to prevent endoparasites and used for the treatment of internal and external injuries in ruminants (Iqbal *et al.,* 2003).The use of feed additives on livestock ration has been widely recognized but with the restriction of use or ban of synthetic antibiotics as feed additives in livestock ration, one expects an increase in the use of natural plants as alternatives. Turmeric has been shown to have several biological effects, exhibiting anti-inflammatory (Holt *et al.,* 1999), anti-oxidant (Iqbal *et al.,* 2003) and hypolipidaemic (Ramirez *et al.,* 1999) activities. It has also been suggested that turmeric possesses hepato-protective, antitumor, antiviral and anticancer activities (Polasa *et al.,* 1999). Reports exist indicating that it has been used in gastrointestinal and respiratory disorders (Anwarul *et al.,* 2006). In view of the significant importance of Turmeric *(Curcuma longa),* this study was conducted to evaluate the effect of dietary levels of raw and cooked Turmeric *(Curcuma longa*) rhizome meal on the performance of the broiler chicks.

Materials and methods

Experimental site

The experiment was carried out in the Poultry Unit of Teaching and Research Farm and the Animal Science Laboratory in the School of Agriculture and Agricultural Technology (SAAT) of the Federal University of Technology, Owerri, Imo state, Nigeria.

Processing of turmeric rhizome

Turmeric rhizomes were procured fresh from National Root Crops Research Institute, Department of Minor Root Crops, Umudike, Umuahia, Abia State, Nigeria. The turmeric rhizomes were washed with tap water and divided into two batches of 20kg each. One batch was processed raw and the other batch was cooked. The first

batch (processed raw) was crushed and sun-dried for 3 days. The second batch was cooked (poured into boiling water and was allowed to boil) for 1hr, the water drained off, crushed and sun-dried for 3 days. The raw and cooked sun-dried turmeric were then ground using a hammer mill to produce raw and cooked sundried turmeric rhizome meals.

Experimental diets

Seven experimental broiler starter diets were formulated incorporating the turmeric meal at seven dietary levels of 0%, 0.5%, 1.0%, and 1.5% raw turmeric and cooked turmeric meals, respectively (table 2).

Table 1 : Proximate composition of raw and cooked turmeric meal (%)

Composition	Raw turmeric	Cooked turmeric
Moisture Content	12.0	7.0
Ether extract	5.0	4.82
Ash	6.0	5.53
Crude fiber	12.0	10.0
Crude protein	14.54	13.72
Nitrogen free extract	52.46	60.28

Table 2: Ingredient and nutrient composition of experimental broiler starter diets

Ingredients (%)	Dietary levels of Turmeric (%)						
	Raw				Cooked		
	0.00	**0.50**	**1.00**	**1.50**	**0.50**	**1.00**	**1.50**
Maize	47.0	47.0	47.0	47.0	47.0	47.0	47.0
SBM	28.0	28.0	28.0	28.0	28.0	28.0	28.0
P K C	5.00	4.50	4.00	3.50	4.50	4.00	3.50
Turmeric	0.00	0.50	1.00	1.50	0.50	1.00	1.50
BDG	9.00	9.00	9.00	9.00	9.00	9.00	9.00
Fish meal	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Wheat offal	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Bone meal	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Salt	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Vit/minpremix*	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Nutrient Composition (%)							
CP	22.0	22.0	21.95	21.90	21.98	21.90	21.87
CF	4.06	4.82	5.20	4.95	5.28	5.50	5.65
EE	4.40	5.10	5.50	5.57	5.10	4.95	5.25
Calcium	1.31	1.37	1.4	1.4	1.37	1.4	1.4
Phosphorous	1.03	1.1	1.13	1.15	1.1	1.13	1.15
NFE	65.28	62.18	60.46	63.36	58.09	66.3	61.06
*ME (kcal/kg)	2872.20	2852.40	2850.70	2845.35	2850.10	2850.30	2846.06

Feeding trial

The processed turmeric rhizome powder milled into the broiler maize-based diets in a feeding trial using a total of 378 (three hundred and seventy-eight) day old unsexed broiler chicks of Cobb-strain were used in the study.The birds were divided into 7 treatments of 54 birds each. Each treatment was further subdivided into 3 replicates of 18 birds each and randomly assigned to one of the 7 experimental diets of 0.00% (control), 0.50%, 1.00% and 1.50% of raw and cooked turmeric respectively.

Management of experimental birds

The chicks were brooded for two weeks for stabilisation using kerosene lamps and stove as source of light and heat in a deep litter system. Polyethylene sheets were also used to cover the pen to provide warmth and

avoid water splashes on the birds. After the 14 days stabilisation period during which, the broiler chicks were fed common control diets, they were fed the experimental diets up to the 35th day of age. The birds were housed in a 2m x 1.8m pen with wood shavings of 2cm height as litter material. Feed and water were provided ad-libitum for all treatment groups throughout the experimental period. Also adequate prophylactic medications and vaccinations were administered. The birds were weighed at the beginning of the experiment and weekly thereafter. Daily feed intake was recorded as the difference between weight of feed offered and the left over the next morning. The study data collected included initial body weight, final body weight, weekly body weight, daily feed intake, weight gain, feed conversion ratio (g feed/g gain). The feeding trial lasted 21 days.

Experimental design

The experiment was conducted in a completely randomised design and all data collected were subjected to analysis of variance (ANOVA) as outlined by Snedecor and Cochran (1978). Where significant differences were observed, treatment means were compared using Duncan's Multiple Range Test as outlined by Obi (1990).

Results and discussion

Chemical composition of both raw and cooked turmeric meals is shown in table 1 while the performance of the broiler starter chicks is shown in table 3. Cooked turmeric meal lost 5.64% of its original crude protein. Other nutrients were not seriously affected by the treatment. Cooked turmeric meal was lower in moisture content (7%) than raw turmeric (12%). Most likely, cooking caused shrinkage of turmeric and this facilitated moisture loss during the subsequent sun-drying. Pruthi (1992) reported that quality of cooked rhizomes is negatively affected for materials with higher moisture content. Concurrently, the ether extract, ash and crude fiber values for cooked turmeric were lower than corresponding values for the raw turmeric counterpart. The higher nitrogen free extract value for cooked turmeric may have resulted from the effect of heat on fiber on the relatively lower moisture content of cooked turmeric compared to raw turmeric. There were no significant ($p>0.05$) effect among the treatment groups in terms of final body weight, total body weight gain, daily body weight gain, daily feed intake, feed conversion ratio and mortality.

However, the group fed diet containing 1.5% cooked turmeric rhizome meal performed better than common control and all other treatment groups with respect to feed conversion ratio (2.05), daily feed intake (88.00g) and daily body weight gain (43.00g). Nouzarian, *et al.* (2011) reported that studies have been conducted to evaluate the effect of turmeric on the

Table 3: Performance of broiler starter chicks fed diets containing graded levels of raw and cooked turmeric meals

	Dietary levels of Turmeric (%)							
	Raw				Cooked			
Parameters (g/bird)	**0.0**	**0.5**	**1.0**	**1.5**	**0.5**	**1.0**	**1.5**	**SEM**
Initial body weight	277.00	277.00	277.00	277.00	277.00	280.00	277.00	5.35
Final body weight	1143.33	1140.00	1147.00	1167.00	1133.33	1200.00	1180.00	17.93
Body weight gain	866.33	863.00	890.00	890.00	856.33	920.00	903.00	19.57
Daily weight gain	41.30	41.09	41.43	42.40	41.00	44.00	43.00	4.67
Daily feed intake	99.00	97.00	89.00	97.00	94.50	98.50	88.00	7.92
Feed conversion ratio	2.39	2.36	2.15	2.28	2.30	2.34	2.05	0.78
Mortality %	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

performance of broiler chickens, laying hens and rabbits and noted that the results have been inconsistent. However, result obtained in this study are in agreement with Nouzarin *et al.* (2011) who reported that supplementation with turmeric rhizome meal showed no significant differences between the groups on body weight changes, daily feed intake and feed conversion ratio. Nonetheless, Nagpal (2013) reported that increasing turmeric inclusion rate in broiler diets could produce significant reduction in feed intake, feed conversion ratio and increase in body weight gain. Reports from Emadi and Kermanshahi (2007) and Durrani *et al.* (2006) indicated that at 5g/kg level of inclusion, turmeric significantly decreased feed consumption of chickens, whereas feed intakes of birds supplemented with 2.5g/kg and 10g/kg levels turmeric had similar values with the control group. However, results obtained from this study on body weight gain are also in concurrence with Emadi and Kermanshashi (2007) who reported that an inclusion rate of 2.5g/kg, 5g/kg and 7.5g/kg of turmeric in diet had no effects on weight gain of broiler chickens. Similarly, Durrani *et al.* (2006) found that though at 2.5g/kg and 10g/kg levels, turmeric had no effect on body weight but at an inclusion of 5g/kg body weight was significantly higher. Dietary supplementation with turmeric may have beneficial effects on the carcass traits of broiler chickens as it contains beneficial phytochemicals, like curcumin, Ar-turmeric, Methyl-curcumin and other active compounds (Al-kassie *et al.*, 2011). Turmeric has also been proven to have ability to stimulate the expression of genes which are involved in antioxidant and immune system of broiler chickens (Yarru *et al.*, 2009). Churchill *et al.* (2000) reported that curcumin treatment increased the number of mucosal CD4(+)T and B cells, suggesting that curcumin modulates lymphocyte-mediated immune functions. These improvements could be attributed to activity of curcumin as an immunostimulant agent (Antony *et al.*, 1999; Yadav *et al.*, 2005). It was concluded that the significant increase in body weight might be due to optimum antioxidant activity of turmeric at the levels of 5g/kg that stimulated protein synthesis by enzymatic systems, however, result obtained from this study showed non-significant effect at the dietary levels used. Durrani *et al.* (2006) reported that chickens receiving diets supplemented with 5g/kg turmeric powder had better feed conversion ratio than 2.5 and 10g/kg supplementation level.

Conclusion

There is no publication as yet that have reported harmful effects of turmeric meal in poultry diets when used at low to moderate concentrations. Interestingly, some authors did not find beneficial effects of supplementing diets with turmeric meal at the rate of 0.5g/kg (Akbaria *et al.,* 2012) or 2.0g/kg (Mehala and Moorthy, 2008). Consumption of excessive dosage of turmeric is not recommended because it may induce hepatotoxic effect as observed in studies with mice (Kandarkar *et al.*, 1998). Al-Sultan and Gameel (2004) recommended that supplementation of broiler diets with more than 50.0g/kg turmeric meal should be avoided as it may contribute to induction of parenchyma land portal infiltration of mononuclear cells and hyperaemia of portal vessels. These reports, including the present study suggested that a lot is yet to be understood on the exact effect and mechanism of turmeric on poultry performance. It was evident that the different processing methods and dietary levels evaluated had no effect on broiler

chicks in this study and within the circumstances of the experiments. It can be concluded that sun-dried raw and cooked turmeric rhizome meal and dietary levels evaluated did not significantly affect broiler performance at the dietary levels evaluated.

References

Al-kassie, G. A. M., Mohseen, A. M. and Abd-Al-jabeel, R. A. 2011. Modification of productive performance and physiological aspect of broiler on the addition of mixture of cumin and turmeric to the diets.*Res. Opin. Anim. Vet. Sci*,1: 31-34.

Al-Sultan, S. I. and Gameel, A. A. 2004: Histopathological changes in the livers of broiler chicken supplemented with turmeric (Curcuma longa). *International journal of Poultry Science,* 3:333-336.

Antony, S., Kuttan, R. and Kuttan, G. 1999. Immunomodulatory activity of curcumin. *Immunol. Investig.* 28:291-303.

Akbarian, A., Golian, A., Kermanshahi, H., Gilani, A. and Moradi, S. 2012. Influence of Turmeric and black peper on blood constituent and broiler performance. *Afr J. Biotechnol.,*11:8606-8611.

Anuwarul, H. G., Abdul, J., Muhammed, N. and Kashifu. 2006. Pharmacological basis forthe use of turmeric in gastrointestinal and respiratory disorders. *Life Science,* 76,3089-3105.

Athanasiadou, S., J. Githiori and I. Kyriazakis. 2007. Medicinal plant for helminthesparasites control: Facts and Fiction. *Animal*. 1 (9):1392 -1400.

Balunas, M. S. and A. D. Kenghora. 2005. Drug discovery from medical plants. *Life Science*, 78 (5): 431-441.

Churchill, M., Chadburn, A., Bilinski, R. T. and Bertagnolli, M. M. 2000. Inhibition of intestinal tumor by curcumin is associated with changes in the intestinal immune cell profile. *Journal of surg. Res.* 89:169-175.

Emadi, M. and Kermanshahi, H. 2007. Effect of turmeric rhizome powder on the activity ofsome Blood Enzymes in broiler chickens. *International journal of Poultry Science*, 6(1):

Holt, P. R., Kats, S. and Kirshoff, R. 2005. Curcumin Therapy in inflammatory bowel disease: *a pilot study, Digest. Dis. Sci.,* 50, 2191-2103.

Iqba, l., Sharma, S. D., Okazaki, Y., Fujisawa, M. and Okada, S., 2003. Dietary influence of turmeric rhizome and black pepper on blood constituents and performance of broiler chickens. *Afr J Biotechnol*., 11:8606-8611.

Kamel, C. 2011. Natural plant extracts classical remedies brings modern animal production solutions. Feed manufacturing in the mediteraneanB region. Improving safety: from feed to food. In *Brufau J. (Ed) Zaragoza*: CIHEAM-IAM2, 31-38.

Kandarkar, S. V., Sawant, S. S., Ingle., A. D., Deshpande, S. S and Maru, O. R. 1998. Subchronic oral hepatotoxicity of turmeric in mice-

histopathological and ultra clinical studies. *Indian. J. Exp. Biol,* 36: 675-679.

Mehala, C. and Moorthy, M. 2008. Production Performance of Broilers Fed with Aloe Vera and curcuma longa (Turmeric). *Int.J. Poult. Sci*., 7 (9): 852-856.

Nagpal, M. S. 2013. Role of curcumin in systemic and oral health: An overview' *Nat.Sci. Biology Med.*, 4 (1): 3-7 d0:10.4103/0976-9668. 107253 pmc 3633300 PMID23633828

National Bureau of Statistics (NBS) 2005. Social Statistics in Nigeria. Federal Republic of Nigeria.

Nouzarian, R., Tabeidian, S. A. and Toghyan, M. 2011. Effect of turmeric powder on performance, carcass traits, humoral immune responses and serum metabolism in broiler chicken. *Journal of Animal. And Feed Science,* 20:389-400

Obi I. U. 1990. Statistical method of detecting difference between treatments means 2nd edition, Snaap press Enugu, Nigeria.

Osawa, T., Sugiyama, Y., Inayoshi, M. and Kawakisi, S. 1995. Anti-oxidative activity of Tetra hydrocurcuminoids. *Biotechbiochem*. 59: 1609- 1616.

Polasa, K., Raghuram, T.C. and Krishna, T. P. 1991. Turmeric (Curcuma Longa L.) induced reduction in urinary mutagens. *Food chem. Toxicol.,* 29, 699-706.

Pruthi, J. S. 1992. Postharvest Technology of spices: pre-treatments, cutting, cleaning, grinding and packing. *Journal of spices and Aromatic crops*. 1(1): 1-29.

Ramirez-Tortosa, M. C., Mesa, M. D., Aguilera, M. C., Quiles, J. L. and Baro L. 1999. Oral Administration of a turmeric extract inhibits LDL oxidation and has hypocholesterolenic effects in rabbits with experimental atherosclerosis. *Altherosclerosis* 147, 371-378.

Snedecor, G. W. and Cochran, W. G. 1978. Statistical method 6th edition Lowa State University press, Amen Lowa.

Toghyani, M., Gheisari, A. A., Ghalamkari, G. and Eghbalsaeid S. 2011. Evaluation of cinnamon and garlic as antibiotic growth promoter substitutions on performance, immune responses, serum biochemical and haematological parameters in broiler chicks. *Livest. Sci*., 13:167-173.

Toghyani, M., Gheisari, A. A., Ghalamkari, G. and Mohammedrezaei, M. 2010. Growth performance, serum biochemistry and blood hematology of broiler chicks fed different levels of black seed (*Nigella sativa)* and peppermint *(Mentha piperita). Livest. Sci*., 129:173-178.

Yadav, V. S., Mishra., K. P., Singh., D. P., Mehrotra, S and Singh., V. K.

2005: Immunomodulatory effects of curcumin. *Immunopbannacol Immunotoxicol.*,27:485-497.

Yarru, L. P., Settivari, R. S., Dowda, N. K. S., Antonio, E., Ledoux, I. R. and Rottinghaus, G. E. 2009. Effects of turmeric (Curcuma longa) on the expression of hepatic gene associated with bio transformation, antioxidant and immune systems in broiler chicks fed aflatoxin. *Poult. Sci.*,88: 2620-2627.

Received: 18th March, 2017

Accepted: 27th July, 2017