EFFECT OF AQUEOUS TURMERIC EXTRACTS ON THE PERFORMANCE AND ECONOMICS OF PRODUCTION EFFICIENCY OF FINISHER BROILERS

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ABSTRACT

The effect of aqueous turmeric extracts on growth performance and economics of production of finisher broilers was investigated using 150 CHI strain broilers in a 28- day feeding trial. Five levels of aqueous turmeric extracts measuring either 0ml, 20ml, 40ml, 60ml or 80ml per litre of water and designated as T_1, T_2, T_3, T_4 and T_5, respectively were used in the trial. The birds were randomly assigned to the five groups at 30 chicks each in a completely randomized design. Each group was replicated 3 times with feed and water offered *ad libitum*. Results showed that turmeric extracts had significant ($p<0.05$) effect on final body weight, body weight gain, daily weight gain and feed conversion ratio of the birds. Birds fed turmeric extracts recorded significantly ($p<0.05$) higher body weight gain and superior feed conversion ratio than the control. There was no significant ($p>0.05$) difference in feed intake and water intake of birds fed the treated and untreated water. Data on economics of production showed that aqueous turmeric extract numerically reduced the cost of feed/kg weight gain, increased the revenue generated and the net return from the birds fed treated water. It could be concluded that feeding of turmeric extract at levels up to 80mls is beneficial to broiler chicken production since it resulted in improved weight gain, feed conversion ratio and showed evidence of improving economics of production.

Introduction

Turmeric rhizome (*Curcuma longa*) is an extensively used spice, as food preservative and coloring material that has biological actions and medicinal applications (Chattopadhyay *et al*. 2004;, Akbarian *et al*. 2012). Turmeric contains 6.3% protein, 5.1% fat, 3.5% minerals, 69.4% carbohydrates, and 13.1% moisture (Chattopadhyay *et al*. 2004). The active ingredients of turmeric rhizomes consist of volatiles and non-volatiles constituents (Dono, 2012). Curcumin is the main important bioactive ingredient responsible for biological activity of *curcuma longa* (Nouzarian *et al*. 2011). Curcumin has been shown to have several biological effects, exhibiting antifammatory (Holt *et al*. 2005), antibacterial (Araújo and Leon 2001), immunomodulatory (Kumari *et al*. 2007 and antioxidative (Hosseini_Vashan *et al*. 2012; Karami *et al*. 2011) properties. It is used in gastrointestinal and respiratory disorders (Anwarul *et al*. 2006). When compared with the synthetic antibiotics, phytochemicals in turmeric are known to be natural, less toxic, residue free, and are thought to be ideal as feed additives in animal diets (Wang *et al*. 2015).

A number of studies have been conducted to evaluate its effect on the performance of broiler chickens, laying hens and rabbits (Samarasinghe *et al*. 2003; Durrani *et al*. 2006; Emadi and Kermanshahi, 2007; Nouzarian *et al*. 2011; Hosseini_Vashan *et al*. 2012). Studies on broiler chickens showed increased weight gain (Samarasinghe *et al*., 2003) and improved FCR (Samarasinghe *et al*., 2003; Wuthi-udomler *et al*., 2000) with dietary supplementation of turmeric. In contrast, Gowda *et al*. (2008); Kumari *et al*. (2007); Mehala and Moorthy, 2008 found no effect of turmeric on FCR. It has been found that the feeding of turmeric rhizome powder in the poultry diet helped to improve the morbidity and mortality of broiler chickens (Al-Kassie *et al*., 2011). It has also been proven that the use of turmeric in poultry feed is of public health benefit with no side effects (Dono, 2014). Yet, the beneficial effects of aqueous turmeric extract on poultry have not been extensively investigated. Therefore, there is need to determine the effect of aqueous turmeric extracts on growth performance and economics of production of broiler finisher.

Materials and Method

Study location: The experiment was carried out at the Poultry Unit of the Teaching and Research Farm of the Department of Animal Science, Faculty of Agriculture and Natural Resources Management, Ebonyi State University, Abakaliki, Source and processing of turmeric: Turmeric rhizomes used for the experiment

were sundried and milled before extraction. The extracts were prepared by soaking 100g dried turmeric in one litre of water for 24 hours. The next morning, the extract was obtained by filtering the infusion using a filter paper

Experimental treatments: Five levels of aqueous turmeric extracts measuring either 0ml, 20ml, 40ml, 60ml or 80ml per litre of water and designated as T_1, T_2, T_3, T_4 and T_5, respectively were used in the trial.

Birds and management: One hundred and fifty, five week-old CHI strain broiler were randomly allotted to five treatment groups in a completely randomized design (CRD) at 30 birds per treatment and designated as T_1, T_2, T_3, T_4 and T_5 respectively. Each treatment groups was further divided into three replicate of 10 birds each. The birds were fed commercial broiler finisher diets. The aqueous extract, water and feed were made available to the birds *ad libitum*. The birds were kept under standard management conditions with adequate provisions for space, light, temperature, ventilation and relative humidity. Vaccination and other routine poultry management practices were maintained.

Data collection and analysis: Chicks were weighed at the beginning of the experiment to obtain their initial body weight and on weekly basis thereafter. Body Weight change was calculated as the difference between the final and initial body weight. Feed intake was taken daily as the difference between the feed offered and left over. Feed conversion ratio (FCR) was computed as the ratio of feed consumption to weight gain. Performance index (PI): was calculated during studied growth periods according to the equation of Kassu *et al*. (2016) *PI* = (live body weight (kg) / feed conversion ratio) x 100. At the end of experiment economics of production of each group was calculated. The feed cost per unit gain was calculated in order to evaluate the profitability of feeding turmeric extracts on the net profit of bird sales

At the end of the study, data thus collected was subjected to analysis of variance (ANOVA) as described by Steel and Torrie (1996). The differences between means were compared by least significance difference test (Steel and Torrie, 1996).

Results and Discussion

Performance Characteristics

Results on the growth performance of finisher broilers fed aqueous turmeric extracts are presented in Table 1.

Table 1: The Effect of aqueous turmeric extracts on the Performance of finisher broilers

Parameters	T_1(0ml)	T_2(20ml)	T_3(40ml)	T_4(60ml)	T_5(80ml)	SEM(±)
Initial body weight (g)	1300.94	1336.95	1307.05	1314.18	1315.13	13.27
Final body weight (g)	2907.04^{b}	3190.54^{a}	3217.19^{a}	3250.75^{a}	3294.14^{a}	110.32
Body weight gain (g)	1606.10^{b}	1853.59^{a}	1910.14^{a}	1936.57^{a}	1979.01^{a}	102.51
Daily weight gain (g)	57.36^{b}	66.20^{a}	68.22^{a}	69.16^{a}	70.68^{a}	8.56
Total feed intake (g)	5048.60	5148.22	5157.67	5275.68	5069.97	101.85
Daily feed intake (g)	180.31	183.86	184.20	188.42	181.07	3.64
Feed conversion ratio	3.14^{b}	2.78^{a}	2.70^{a}	2.72^{a}	2.66^{a}	0.24
Total water intake(ml)	8166,2	8116.08	8018.08	7822.16	7742.28	225
Daily water intake(ml)	291.65	289.86	286.36	279.36	276.51	9.12
Performance Index	92.58 ^{c}	114.77^{ab}	119.16^{ab}	119.51 ^{ab}	123.84^{a}	4.87

a, b, Means with different superscripts along the same row are significantly (P<0.05) different.

Table 1 revealed significant (P<0.05) differences in the final body weight, body weight gain, daily weight gain and feed conversion ratio of the birds among the treatments. Birds fed aqueous turmeric extracts (T_2, T_3, T_4 and T_5) had significantly (p<0.05) higher weight gain and better feed conversion ratio than birds on the control (T_1). There was no significant difference (P>0.05) in final body weight, body weight gain and daily weight gain of the birds (T_2, T_3, T_4 and T_5) fed aqueous turmeric extracts. Aqueous turmeric extracts significantly improved the weight gain of the treated birds. The improvement in protein utilization, absorption and suppression of gram negative bacteria and Chlostridium that cause growth depression might be the reason for the improvement in body weight gain and feed conversion ratios (cite a reference). There were some reports which show that turmeric had the ability to stimulate the digestive

system, such as stimulate the intestinal lipase, sucrase and maltase activities (Platel and Srinivasan, 1996) as well as the secretion of pancreatic lipase, amylase, trypsin and chymotrypsin enzymes (Platel and Srinivasan, 2000). Therefore, there is a possibility to suggest that improvement on the growth performance due to dietary turmeric meal in broiler chickens is attributed to the improved digestive system in the body. Better feed conversion ratio of the broilers on turmeric extract may be attributed to the antibacterial properties of turmeric, which resulted in better absorption of the nutrients present in the gut and ultimately leading to improvement in feed conversion ratio. Results of this present are in line with Rajput *et al*. (2013) who reported that curcumin enhanced weight gain and feed conversion ratio of broiler chickens. Our finding disagrees with reports by Samarasinghe *et al.*(2003), Hosseini-Vashan *et al.* (2012), Wang *et al.*(2015) and Isroli *et al.*(2016) who reported non- significant effect of turmeric on weight gain and feed conversion ratio.

Turmeric extracts did not significantly influence feed and water intakes of the birds. However, birds fed aqueous turmeric extracts had numerically higher feed intake compared to the control birds. This findings were in accordance with Samarasinghe *et al.* (2003) and Sadeghi *et al*. (2012) showing the non-significant effect of turmeric on feed intake.

Results on Performance index indicated that there were significant differences among treatments in PI. Birds on 80ml (T_5) had significantly ($p<0.05$) higher PI followed by birds fed 60ml, 40ml and 20ml. Birds on 0ml had the lowest PL

Economic of production

The cost effectiveness of feeding aqueous turmeric extracts to finisher broilers are presented in Table 2

Table 2: Economic efficiency of feeding aqueous turmeric to finisher broilers

Parameters	T_1	T_2	T_3	T_4	T_5	SEM
Cost of bird (₦)	1200.00	1200.00	1200.00	1200.00	1200.00	
Cost of feed/kg (₦)	158.00	158.00	158.00	158.00	158.00	
Total feed consumed/bird (g)	5048.60	5148.22	5157.67	5275.68	5069.97	101.85
Medication and miscellaneous (₦)	68.00	68.00	68.00	68.00	68.00	
Body weight gain (g)	1606.10^{b}	1853.59^{a}	1910.14^{a}	1936.57^{a}	1979.01^{a}	102.51
Cost of feed consumed/bird (₦)	797.68^{c}	813.42^{b}	814.91^{b}	833.56^{a}	801.06^{c}	81.06
Feed cost /kg weight gain/bird(₦)	496.66^{a}	438.83^{b}	426.62^{b}	430.43^{b}	404.78^{c}	7.75
Total cost of production (₦)	2065.68	2081.42	2082.91	2101.56	2069.06	60.43
Cost of meat/kg (₦)	1000.00	1000.00	1000.00	1000.00	1000.00	
Revenue generated /bird (₦)	2,907.04^{b}	3,190.54^{ab}	3,217.19^{a}	3,250.75^{a}	3,294.14^{a}	20.58
Net return/bird (₦)	841.36^{b}	1109.12^{a}	1134.28^{a}	1149.19^{a}	1225.08^{a}	12.08
Economic efficiency	1.05^{c}	1.36^{b}	1.39^{ab}	1.37^{b}	1.53^{a}	0.03
Relative economic efficiency	100.00^{b}	129.52^{b}	132.38^{b}	130.48^{b}	145.71^{a}	5.71

The results of economics of production of feeding turmeric extract is presented in Table 2. Results revealed that the cost of feed consumed were significantly ($p<0.05$) higher for 20ml, 40ml and 60ml aqueous turmeric extract treated birds. Birds fed 0ml and 80mltrmeric extracts had significantly ($p<0.05$) reduced the cost of feed consumed. Feeding of aqueous turmeric extract significantly ($p<0.05$) reduced the cost of feed/kg weight gain, increased the revenue generated and the net return from the treated birds. Feeding of aqueous turmeric extract also significantly ($p<0.05$) improved the economic efficiency. The input-output analysis showed that significantly ($p<0.05$) the highest REE was recorded by the chicks fed 80ml (T_5) followed by birds fed 60ml, 40ml and 20ml. Birds in T_1 recorded the least revenue generated, net return and EE while cost of feed/kg weight gain was the highest. These results indicated that feeding turmeric extracts were more economical than the control. This improvement could be due to the improvement in feed conversion ratio or reduction in amount of feed required to produce one unit of meat. These findings are in agreement with observations of Ahmad (2005) and Mahmood *et al.* (2014) who

reported that increase in the profit margin from the birds fed ration containing commercial herbal growth promoters might be attributed to the better efficiency of feed utilization, which resulted in more growth and better feed conversion ratio, ultimately leading to a higher profit margin of the broilers reared on ration supplemented with commercial herbal products.

Conclusion

Spices have been reported to be natural feed additives due to their suitability, preference, lower cost of production, and environmentally friendly. The feeding of turmeric extracts to finisher broilers at levels up to 80mls per litre of water is beneficial to broiler chicken since it resulted to improved weight gain, feed conversion ratio and showed higher indication of economic gain.

References

Ahmad, S. 2005. Comparative efficiency of Turmeric, garlic, Cinnamon and kalongi as growth promoter in broiler. M.Sc. (Hons.) Thesis, Department Poultry Sciences, University of Agriculture, Faisalabad, Pakistan.

Akbarian, A., Golian, A., Kermanshahi, H., Gilani, A. and Moradi, S. 2012. Influence of turmeric rhizome and black pepper on blood constituents and performance of broiler chickens. *Afr. Biotechnol.* 11:8606-8611.

Al-Kassie, G.A.M, Mohseen, A.M., Abd-Al-Jaleel, R. A. 2011. Modification of productive performance and physiological aspects of broilers on the addition of a mixture of cumin and turmeric to the diet. *Res Opin Anim Vet Sci*. 1:31-34.

Araújo CAC, Leon LL. 2001. Biological activities of *Curcuma longa* L. *Memórias do Instituto Oswaldo Cruz*. 96:723-728.

Chattopadhyay, I., Biswas, K., Bandyopadhyay, U. and Banerjee, R.K. 2004. Turmeric and curcumin: Biological actions and medicinal applications. *Curr Sci*. 87:44-53.

Dono, N.D. 2014. Turmeric (Curcuma longa Linn.) supplementation as an alternative to antibiotics in poultry diets. WARTAZOA. *Indonesian Bulletin Anim. Vet. Sci*. 23(1):41-49.

Durrani F.R, Ismail, M. Sultan, A. Suhail, S.M., Chand, N. and Durrani, Z. 2006. Effect of different levels of feed added turmeric (Curcuma longa) on the performance of broiler chicks. *J.Agric. Biol. Sci.* 1:9-11.

Emadi, M., Kermanshahi, H. and Maroufyan, E. 2007. Effect of varying levels of turmeric rhizome powder on some blood parameters of broiler chickens fed corn soyabean meal based diets. *Int. J. Poult. Sci*., 6(5): 345-348

Gowda, N.K.S., Ledoux, D.R., Rottinghaus, G.E., Bermudez, A. J. and Chen, Y. C. 2008. Efficacy of turmeric (*Curcuma longa*), containing a known level of curcumin, and a hydrated sodium calcium aluminosilicate to ameliorate the adverse effects of aflatoxin in broiler chicks. *Poult Sci*. 87:1125-1130.

Hosseini-Vashan, S.J., Golian, A., Yaghobfar, A., Zarban, A., Afzali, N and Esmaeilinasab, P. 2012. Antioxidant status, immune system, blood metabolites and carcass characteristic of broiler chickens fed turmeric rhizome powder under heat stress. *Afr. J. Biotech.* 11(94): 16118-16125.

Isroli, I., Yudiarti, T., Widiastuti E, and Sugiharto, S. 2016. Effect of decocted turmeric on performance, hematological parameters and carcass traits of broiler chickens *J. Indonesian Trop. Anim. Agric.* 42(4):263-269

Kassu,Y., Tamir, B. and Tesfaye, E. 2016. Effect of Supplementing Natural Feed Additives: Black Cumin,Fenugreek and Turmeric on the Growth Performance and Economic Efficiency of Broiler Chickens. *Adv. Biol. Research* 10 (5): 335-344,

Kumari P, Gupta MK, Ranjan R, Singh KK, Yadava R. 2007. Curcuma longa as feed additive in broiler birds and its patho-physiological effects. *Indian J Exp Biol*.45:272-277.

Mehala, C. and Moorthy, M. 2008. Effect of *Aloe vera* and *Curcuma longa* on carcass characteristics and biochemical parameters of broilers .*Int. J. Poult.Sci*.,7(9): 857-861.

Nouzarian, R., Tabeidian, S.A., Toghyani, M., Ghalamkari, G. and Toghyani, M. 2011. Effect of turmeric Powder on Performance, Carcass Traits, Humoral Immune Responses and Serum Metabolites in Broiler Chickens, *J. Anim. Feed Sci.*, 20: 389-400.

Platel, K. and K. Srinivasan, 1996. Influence of dietary spices or their active principles on digestive enzymes of small intestinal mucosa in rats. *Int. J. Food Sci. Nutr.*, 47: 55-59.

Platel, K. and K. Srinivasan, 2000. Influence of dietary spices and their active principles on pancreatic digestive enzymes in albino rats. *Food/Nahrung,* 44: 42-46.

Rajput, N., Muhammah, N., Yan, R., Zhong, X. and Wang, T. 2012. Effect of dietary supplementation of curcumin on growth performance, intestinal morphology and nutrients utilization of broiler chicks. *J Poult Sci*. 50:44-52.

Samarasinghe, K., Wenk, C., Silva, K.F.S.T. and Gunasekera, J.M.D.M. 2003. Turmeric (*Curcuma longa*) root powder and mannanoligosaccharides as alternatives to antibiotics in broiler chicken diets. *Asian- Austral. J. Anim. Sci*. 16:1495-1500.

Steel, R.G.D. and Torrie, J.H. 1996. *Principles and Procedures of Statistics: A Biometric Approach,* 3rd edition. McGraw Hill Book Comp. Inc. New York.

Wang, D., Huang,H., Zhou,L., Li, H. Zhou, W. and Hou, G. 2015. Effects of dietary supplementation with turmeric rhizome extract on growth performance, carcass characteristics, antioxidant capability, and meat quality of Wenchang broiler chickens. *Ital. J. Anim. Sci*. 14:3.

Wuthi-udomler, M., Grisanapan, W., Luanrtana, O.and Caichompoo, W. 2000. Antifungal Activity of Curcuma Longa Grown in Thailand. *South East Asian J. Trop. Med. Public Health*. 31:178-182.