Physiological response of Nigerian indigenous cocks fed diet with graded levels of tumeric (*Cucumma longa*)

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Abstract

This study was conducted to evaluate the physiological response of Nigerian indigenous chicken (cock) fed graded levels of Tumeric Rhizome Powder (TRP). Sixty (60) adult local cocks divided into 4 groups with 15 birds in each group, replicated into 3 of 5 birds per replicate in each treatment group were used for the study. The birds in the experimental groups designated as T_1 , T_2 , T_3 , and T_4 were fed with TRP supplemented diet at various inclusion levels of 0.0, 0.25, 0.50 and 0.75%, respectively for 8 weeks. From the results obtained, the growth performance and the relative organ yields were significantly ($p < 0.05$) enhanced, with an average weight of 121.33 ± 14.70 of the experimental birds in the Turmeric groups. The nutrient digestibility was significantly ($p < 0.05$) improved with TRP supplemented diet. The result of the organ weight recorded showed the weight of the visceral organs such as heart, liver, lungs, spleen, pancreas and the gizzard relative to body weight were not significantly ($p > 0.05$) affected by the turmeric supplemented diet compared with the control group, whereas the dressed weight, the size of the kidney, proventriculus and the gall bladder relative to body weight were significantly ($p < 0.05$) increased, although no statistical difference between the 0.25% and 0.75% inclusion groups compared with the control group. The significant ($p < 0.05$) increase in the size of proventriculus which is responsible for the mechanical storage of the ingested feed could be attributed to the effect of turmeric supplemented diet compared to control. Also, the gall bladder contained significantly ($p < 0.05$) increased volume of the bile. In conclusion, Turmeric powder supplemented diet at 0.25 and 0.5 % inclusions performed better in improving the growth of Nigerian indigenous cocks, although care should be exercised in prolonged supplementation above 0.5 % inclusion to prevent its deleterious effect on the blood profile. From the findings in this study, to achieve a better growth performance of the Nigerian indigenous cocks with little or no effect on the relative organ weight, 0.5 % inclusion level is highly recommended.

Keywords: Tumeric, Nigerian Indegenous Cock, Body Weight and Organ weight.

Introduction

Indigenous chicken constitutes 80% of the 120 million poultry types raised in the rural areas in Nigeria (RIM, 1992). They are self-reliant and hardy birds with the capacity to withstand harsh weather condition and adaptation to adverse environment. They are known to possess qualities such as the ability to hatch their own eggs, brood and scavenge for major parts of their food and possess appreciated immunity from endermic diseases. Their products are preferred by the majority of Nigerians

because of the pigmentation, taste, leanness and suitability for special dishes (Horst, 1989). The outputs (egg and meat) are readily available to villagers and people in urban, semi-urban areas thus serve as a good source of protein in their diet, in the same vein, they serve as good source of income (Sonaiya *et al.*, 1999). The local chicken of Nigeria is small in size and grow slowly. There have been reports on the characterization of the local chicken in Nigeria and its potential for egg and meat production (Adebambo, 2005). Even

though the productivity of local chicken is poor, they are very important to withstand certain harsh environmental conditions, can perform better under poor management than cross and exotic breeds, they are also well known to possess desirable characters such as ideal mother, good sister, hatch their eggs, excellent foragers, resistant to common poultry diseases and special meat and egg qualities (flavor), hard egg shells (Abdelqader *et al.*, 2007). Bioactive plant substance in which have been proved to be very effective in animal nutrition may include the stimulation of appetite and feed intake, improvement of endogenous digestive enzyme secretion, activation of immune response, antibacterial, antiviral and antioxidant actions (Toghyani *et al.*, 2010; 2011). Turmeric (*Curcuma longa*) is a tropical plant native of Southern and South-eastern tropical Asia. Curcumin is the main important bioactive ingredient responsible for the biological activity of turmeric. Curcumin has been shown to have several biological effects exhibiting anti-inflammatory (Holt *et al.*, 2005), antioxidant (Igbal *et al.*, 2003) and hypolipidaemic (Ramirez-Toritos *et al.*, 1999). It is used in gastrointestinal and respiratory disorders (Anwarul *et al.*, 2006). The significant biological properties of turmeric powder make it a potential substitute for feed antibiotics in livestock diets. A number of studies have been conducted to evaluate its effects on the performance of broiler chickens (Suriya *et al.*, 2012; Nayaka *et al.*, 2013; Abou-Elkhair *et al.*, 2014 and Olukosi and Dono,

2014). However, the results of these studies have been inconsistent keeping in view of the medicinal attributes of *Curcuma longa*, the purpose of this study therefore was to evaluate the physiological response of the indigenous cocks fed diets Turmeric Rhizome powder.

Materials and methods

The research was carried out in the Poultry Unit of the University Teaching and Research Farm of Michael Okpara University of Agriculture, Umudike, Abia State in the South Eastern Nigeria. Umudike falls within latitude 5° 28' North and longitude 07° 35' East and lies at an altitude of 112m above sea level. The location has an annual precipitation rainfall of 177-2,000cm per annum, (April–October) and a short period of dry season (November–March) with a relative humidity of about 50-90% and monthly temperature range of 17°C -36°C. (Meteorological Station-NRCRI, Umudike, 2017).

The harvested rhizomes of turmeric plant that was used for this study was obtained from a reliable source. The rhizomes were carefully washed, peeled and steamed to remove the raw odour. It was dried in the oven at a temperature of 65°C. The dried rhizomes were polished to remove the rough surface by handpicking and finally milled into turmeric rhizome powder meal using hammer mill. The meal was then used to formulate the bird's experimental diet containing 0.00, 0.25, 0.50 and 0.75% for treatments T1, T2, T3, and T4, respectively. The gross composition of the experimental diet with different levels of TRP Powder is shown in Table 1.

Table 1: Gross composition of the experimental diet with different level (%) of turmeric rhizome powder

<i>Ingredient</i>	<i>T₁ 0%</i>	<i>T₂ 0.25%</i>	<i>T₃ 0.50%</i>	<i>T₄ 0.75%</i>
Maize	47.3	47.3	47.3	47.3
Soya bean meal	21	21	21	21
Wheat offal	18	18	18	18
Bone meal	2	2	2	2
Palm kernel cake	10	10	10	10
Premix	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25
Methionine	0.1	0.1	0.1	0.1
Lysine	0.1	0.1	0.1	0.1
Total	100	100	100	100
Turmeric	0	0.25	0.50	0.75
Calculated Composition of TRP				
Crude Protein	16.02	16.02	16.02	16.02
ME (kcal/kg)	2,691	2,691	2,691	2,691

Management of experimental animals

Sixty 8weeks old matured normal feathered local cocks were used for this experiment. The birds were procured from Oriegbe Market in Abakaliki, Ebonyi State. The birds were weighed, and then randomly assigned to four experimental diets of 4 treatment groups of 15 birds per treatment. Each treatment group was further divided into 3 replicates giving 5 birds per replicate per treatment group. The levels of Turmeric Rhizome Powder (TRP) that was included in the diet were 0.0, 0.25, 0.50 and 0.75% represented as T₁, T₂, T₃, T₄, respectively (Table 1). Treatment 1 (T₁) which contained no TRP was used as the control. The birds were raised for 6 weeks in deep litter. Feed and water were supplied *ad-libitum*. The trial lasted 45 days. Four weeks after TRP administration, two cocks from each replicate were selected and the final weigh of the birds were taken.

Statistical analysis

Data collected in all the parameters measured were subjected to Analysis of Variance (ANOVA) in a Completely Randomized Design (CRD) as outlined by Steel and Torrie (1980). The treatment means were separated using Duncan's New Multiple Range Test at 5% probability as

described by Obi (1990).

Results and discussion***Effect of tumeric on growth performance of Nigerian indigenous cocks fed diet with graded levels of tumeric (Cucumma longa)***

The effect of turmeric on the growth performance indices of Nigerian indigenous cocks fed diet with graded levels of tumeric (*Cucumma longa*) is shown in Table 2. Although, all the groups received same quantity of feed (400g/day), but the quantity of voluntary feed intake/bird/gram, the amount of leftover (feed refused), the average weight gain/bird/gram, the Feed Conversion Ratio and feed efficiency were significantly ($p < 0.05$) varied between the tumeric treated groups and control group. The result showed that the birds in the 0.0% tumeric inclusion level voluntarily consumed significant ($p < 0.05$) greater quantity of the feed compared with the birds placed on turmeric supplement at various inclusion levels. The lower voluntary feed intake recorded in the turmeric groups could be due to depressed appetite as the turmeric concentration was increased as shown by the quantity of left overs, though this

Physiological response of Nigerian indigenous cocks

depressed appetite did not significantly ($p > 0.05$) differ among the treatment groups. This observation is very similar to the studies of Habeeb *et al.* (1994); Prasad and Karim (1996) and Marai *et al.* (2006). The birds in the turmeric groups with higher inclusion levels of 0.5 and 0.75% significantly ($p < 0.05$) gained more weight compared with the control. The insignificant ($p > 0.05$) difference in the average weight gain in 0.25% compared with control could be due to lower inclusion level of the turmeric powder. Basavaraji *et al.*, (2010) reported similar finding when the turmeric powder was included at 0.25% compared with the 0.0% turmeric group. The relatively lower average weight gain of birds in 0.75% inclusion group compared to those of birds in 0.5% inclusion level may be due to increased depression of appetite at higher inclusion of the turmeric. This finding is in agreement with the observation made by Marai *et al.* (2006), that 0.5% inclusion of turmeric powder significantly increase weight gain in chicks, and with Durrani *et al.* (2006) who reported that at 0.25% (lowest) and 1.00% (highest) levels of turmeric had no significant effect on body weight but at 0.5% level, birds gained significantly higher body weight. In this study the birds at 0.5% inclusion gained 121.33 ± 14.70 g compared with 105.66 ± 25.02 g at 0.25% inclusion and 114.00 ± 12.61 g at 0.75% inclusion. This significant

effect of the turmeric powder on weight gain however disagreed with the study done by Emadi and Kermanshashi (2006) who reported that at 0.25, 0.5 and 0.75% levels of turmeric, there was no significant effect on the weight gain of chicks fed turmeric supplemented feed compared with chicks fed non-turmeric supplemented feed.

Ramirez-Tortosa *et al.* (1999) and Marai *et al.* (2006) reported a direct relationship between FCR and average weight gain of birds and rabbit, respectively fed with turmeric powder. It was observed that birds in the turmeric groups gained an average weight of 1g by consuming little quantity range 0.52 – 0.60 g of the formulated feed whereas birds in the control group consumed about 2g of the 0.0% turmeric formulated feed to gain an equivalent of 1g of body weight. This means that turmeric powder at the various inclusions, elicited significantly ($p < 0.05$), better FCR compared with the control. The increased percentage feed efficiency observed in the turmeric groups range from 139.31 ± 23.81 to $169.11 \pm 17.83\%$ could be due to increased activity of digestive enzymes such as trypsin, chymotrypsin, and amylase in the turmeric groups compared with the non-turmeric group, which increased the digestibility of the nutrients contained in the formulated feed. Patel and Srinivasan (2000); Salin and Kucuk (2001) and Kiran (2005) reported similar observations.

Table 2: Effect of turmeric powder on growth performance of Nigerian indigenous cocks fed diet with graded levels of tumeric (*Cucumma longa*)

Parameters	Treatment (Turmeric)			
	T ₁ 0.0%	T ₂ 0.25%	T ₃ 0.5%	T ₄ 0.75%
Average quantity of feed given (g)	400.00 $\pm$ 0.00	400.00 $\pm$ 0.00	400.00 $\pm$ 0.00	400.00 $\pm$ 0.00
Voluntary Feed intake/bird/g	85.76 $\pm$ 2.57 ^a	67.75 $\pm$ 1.45 ^b	67.64 $\pm$ 1.41 ^b	67.38 $\pm$ 1.07 ^b
Feed refusal/bird/g	39.33 $\pm$ 1.76 ^c	53.42 $\pm$ 2.71 ^b	64.16 $\pm$ 2.41 ^a	67.13 $\pm$ 2.21 ^a
Average Weight gain/bird (g)	51.03 $\pm$ 19.25 ^b	105.66 $\pm$ 25.20 ^{ab}	121.33 $\pm$ 14.70 ^a	114.00 $\pm$ 12.16 ^a
Feed Conversion Ratio (FCR)	2.04 $\pm$ 0.65 ^a	0.52 $\pm$ 0.25 ^b	0.57 $\pm$ 0.08 ^b	0.60 $\pm$ 0.06 ^b
Feed Efficiency (%)	63.14 $\pm$ 22.59 ^b	139.31 $\pm$ 23.81 ^a	179.69 $\pm$ 22.88 ^a	169.11 $\pm$ 17.83 ^c

Note: Values are presented as means $\pm$ S.E.M, where a, b & c represents significant differences. Values of $p < 0.05$ is consider ed significant.

Relative organ weight of Nigerian indigenous cocks fed diet with graded levels of tumeric (*Cucumma longa*)

The relative organ weight of Nigerian indigenous cocks fed diet with graded levels of tumeric (*Cucumma longa*) is presented in Table 3. The result shows the weight of the visceral organs such as heart, liver, lungs, spleen, pancreas and the gizzard relative to body weight were not significantly ($p > 0.05$) affected by the turmeric supplemented diet compared with the control group, whereas the dressed weight, the size of the kidney, proventriculus and the gall bladder relative to body weight were significantly ($p < 0.05$) increased, although no statistical difference was observed between the 0.25% and 0.75% inclusion groups compared with the control group. The significant ($p < 0.05$) increase in the size of proventriculus which

is responsible for the mechanical storage of the ingested feed could be attributed to the effect of turmeric supplemented diet compared to control. Also, the gall bladder contained significantly ($p < 0.05$), increased volume of the bile and this increase in the bile volume could be as a result of increased activity on the digestible nutrient by the pancreatic organ of birds at 0.75% inclusion. It is very important to note that all the birds in the turmeric supplemented diet groups, weighed heavier ($p < 0.05$) than the birds in the control group which implies that feeding birds with turmeric supplemented diet at the various inclusions used in this study could improve the market size or growth performance of the birds. This study showed great similarities to the works reported by Patel and Srinivasan (2000); Kazim *et al.* (2001); Ishita *et al.* (2004) and Marai *et al.* (2006).

Table 3: Effect of turmeric on the relative Organ Weight / Viscerosomatic Index of Nigerian indigenous cocks fed diet with graded levels of tumeric (*Cucumma longa*)

Parameters	Treatment (Turmeric)			
	T ₁ 0.0%	T ₂ 0.25%	T ₃ 0.5%	T ₄ 0.75%
Dressed Weight (kg)	1.08 ± 0.03 ^b	1.25 ± 0.06 ^{ab}	1.33 ± 0.08 ^a	1.33 ± 0.02 ^a
Heart (%)	0.59 ± 0.09	0.57 ± 0.00	0.57 ± 0.02	0.60 ± 0.49
Liver (%)	1.81 ± 0.31	1.77 ± 0.13	1.75 ± 0.12	1.77 ± 0.19
Lungs (%)	0.64 ± 0.31	0.62 ± 0.09	0.76 ± 0.06	0.71 ± 0.08
Kidney (%)	0.49 ± 0.04 ^a	0.33 ± 0.01 ^b	0.41 ± 0.03 ^{ab}	0.38 ± 0.03 ^{ab}
Proventriculus (%)	0.34 ± 0.03 ^b	0.39 ± 0.01 ^{ab}	0.49 ± 0.04 ^a	0.43 ± 0.02 ^{ab}
Spleen (%)	0.14 ± 0.01	0.13 ± 0.01	0.13 ± 0.05	0.08 ± 0.00
Gall Bladder (%)	0.06 ± 0.01 ^b	0.07 ± 0.00 ^{ab}	0.07 ± 0.00 ^{ab}	0.11 ± 0.02 ^a
Pancrease (%)	0.18 ± 0.03	0.17 ± 0.00	0.19 ± 0.01	0.15 ± 0.01
Gizzard (%)	3.33 ± 0.48	3.20 ± 0.33	4.03 ± 0.12	3.16 ± 0.59

Note: Values are presented as means ± S.E.M, where a and b represent significant differences. Values of $p < 0.05$ is considered significant.

Conclusion and recommendations

The type of food supplement or diet formulations and feeding regimen have a great impact on the growth performance of the Nigerian indigenous chickens which has a direct influence on their reproductive performance. The result of the growth

performance showed that supplementing the diet of our local cocks with Turmeric powder especially, at 0.5 % inclusion level will enhance the weight gain and the average market size of about 1.33 kg which will make it comparable to other hybrid chickens used as meat. Although, the

Turmeric powder has no significant deleterious effect on the major organs which make it very safe for inclusion in the diet of our local indigenous cocks, but prolonged usage could result in mild effects on the birds.

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