DIETARY ADDITION OF TURMERIC (*Curcuma longa*) RIIIZOME POWDER AND CAYENNE PEPPER (*Capsicum frutescens*) POWDER ON CARCASS TRAITS OF BROILER CHICKENS

***Adegoke, A.V., Abanikanda, I.A., Sanwo, K.A., Egbeyale, L.T. and Abiona, A.A**
Department of Animal Production and Health, Federal University of Agriculture, P.M.B. 2240, Abeokuta, Nigeria.
**Corresponding author: adegokedl@gmail.com, +2347032662737*

Abstract
This experiment was carried out to determine carcass attributes of broiler chickens fed dietary turmeric (Curcuma longa) powder (Tur) and cayenne pepper (Capsicum frutescens) powder (Cay) as antioxidants. Two hundred and forty-three 2-weeks old broiler chicks were allotted into nine treatment groups. Each group consists of 27 randomly selected birds and three replicates of nine birds each. Three levels of Tur (0, 2 and 4 g/kg) and three levels of Cay (0, 1 and 2 g/kg) were used to formulate nine dietary treatments, which were randomly fed to each group for 8 weeks. At the expiration of the 8th week, carcass indices were measured and recorded. Groups fed 2 & 4 g/kg Tur had significantly high ($p<0.05$) plucked and eviscerated weight than groups fed other dietary inclusions. Dressed weight percentage was most influenced in birds fed 2g/kg Tur and 2g/kg Cay, but thigh and drumstick values were high ($p<0.05$) for birds fed 4g/kg Tur + 1g/kg Cay. However, results showed no response ($p>0.05$) to dietary treatments fed for carcass back and wings. All measured parameters for internal organs were significantly different ($p<0.05$), with the exception of carcass spleen. Therefore, inclusion of turmeric at 2g/kg should in diets improve dressed percentage of broiler chickens.

Key words: Turmeric, cayenne pepper, carcass, broiler chicken

Introduction

The term feed additive is applied in a broad sense, to all products other than those commonly called feedstuffs, which could be added to the ration with the purpose of obtaining some special effects (Mondal *et al*., 2015). Turmeric rhizome powder has the scientific name *Curcuma longa,* and itis locally called ata ile pupa in the western region of Nigeria. The active ingredients found in Turmeric (*Curcuma longa)* are curcumin, demethoxy-curcumin, bisdemethoxycurcumin, (Wuthi-Udomler *et al*., 2000) and tetrahydrocur-cuminoids (Osawa *et al*., 1995). According to Ogunlade *et al*. (2012), cayenne pepper is locally known as Ata sombo in western Nigeria, and Nigeria is the largest pepper producer in tropical Africa. Grubben and Tahir (2004) reported FAO statistics estimation of tropical Africa production of pepper at 1 million tonnes, with Nigeria sole cropping yield of 0.8 t ha-1. Capsaicin (CAP, 8-methyl-N-Vanilly-6-nonenamide) is the active substance responsible for the irritating and pungent effects of various species of hot pepper (Govindarajan and Sathyanarayana, 1991). Hence, pepper is an important crop not only because of its economic importance but also for the nutritional value of its fruits being a major source of natural colours and antioxidant compounds (Howard *et al*., 1994). Combination of antioxidants can act synergistically, i.e. affect oxidation to a higher extent than the sum of the contributions from each single antioxidant (McCarthy *et al*., 2001). This study is therefore designed to experiment the anti-oxidative effect of turmeric (*Curcuma longa*) and cayenne pepper (*Capsicum frutescens*) on carcass characteristics of broiler chickens.

Materials and Methods

Experimental site: The experiment was carried out at the poultry unit of the Directorate of University farm (DUfarm), Federal University of Agriculture Abeokuta, Nigeria.

Experimental birds and management: A total of 270 day-old broilers was purchased from a reputable commercial hatchery in Abeokuta in Ogun State. The birds were divided into nine treatments groups of 30 birds per treatment. Each group was further divided into 3 replicates of 10 birds each. Turmeric (t) and cayenne (c) were included at varying in the control diets. The treatments groups are; control, 200tur, 400tur, 100cayenne, 200cayenne, 200t+100c, 400t+100c, 200t+200c and 00t+200c.The experiment lasted for eight weeks. The control diet formulation was maize 52%, wheat offal 4.30%, fish meal 2.2%, soybean 18.5%, GNC 17%, bone meal 3%, limestone 2%, lysine 0.25%, methionine 0.25%, premix 0.25% and common salt 0.25% at starter phase while the control diet formulation at finisher phase was maize 58.4%, wheat offal 1o.6%, fish

meal 1%, soybean 10%, GNC 14%, bone meal 3%, limestone 2%, lysine 0.25%, methionine 0.25%, premix 0.25% and common salt 0.25%.

Carcass Characteristics: At the end of 8 weeks, one bird of average weight of each replicate was selected and fasted for 12 hours overnight to clear the gut. The live weight of the selected birds was determined before slaughtering. Therefore, the birds were slaughtered via neck slit, bled properly and was dissected into cut up parts (Head, neck, wings, chest, back, thigh, drumstick, shanks), organ (gizzard, liver, heart, kidney, lungs and spleen) and offals (intestine and fats) and weighed. In addition, the dressing percentage was also calculated by multiplying the quotient of the weight and live weight by 100. Fat around the cloaca, bursa of *Fabricius*, proventriculus, and muscles adjacent to the abdomen were considered as abdominal fat deposit (Cahaner *et al.*, 1986). One bird per replicate was slaughtered and eviscerated after being weighed at day 56. Abdominal fat was taken out and weighed.

Statistical Analysis: Data obtained were subjected to one-way analysis of variance and analyzed using the general linear model procedure of SPSS (2011) version 20, Treatment means with significant difference at $p<0.05$ were compared using Duncan Multiple Range Test (DMRT) of the statistical package.

Results and Discussion

The results on the carcass weight are presented on Table 1. Live weight was highest ($p<0.05$) in chickens fed dietary addition of 2g/kg tur + 1g/kg cay (1603.33g) but least in birds fed 2g/kg cayenne as dietary additive (1500.00g). Plucked and eviscerated weights of birds fed 2g/kg (1420g, 1173.33g) and 4g/kg (1405; 1157.67g) dietary turmeric had highest ($p<0.05$) values, but least values for the control group (1218.00g; 1040g). Dressing percentage of chickens fed 2g/kg turmeric (68.94%) and 2g/kg cayenne pepper (68.60%) as dietary additives were higher than others, though similar to values recorded for chickens fed 4g/kg tur (64.55%), 1g/kg cayenne (62.14%) 2g/kg tur + 1g/kg cay (63.74%), 4g/kg tur + 1g/kg cay (64.89%) and 4g/kg tur + 2g/kg cay (62.19%).The significant ($P<0.05$) effect of turmeric powder on the weight of internal organs (heart, liver and gizzard) of broilers fed experimental rations clearly disagree with the observation of some authors (Lal *et al.*, 1999; Al-Sultan *et al.*, 2003, Mondal *et al.*, 2015), who reported that feeding of turmeric did not alter the size of liver, gizzard, heart. Thigh percentage was high ($p<0.05$) in groups fed 2g/kg tur (11.16%), 1g/kg cay (11.11%) and 4g/kg tur + 1g/kg cay (11.12%) dietary additives, while drumstick values ranged from 8.94 to 11.22 %. However, birds fed 4g/kg + 1g/kg had the highest (11.22%) among treatment groups. All internal organ parts were significantly ($p<0.05$) influenced by dietary additives, except spleen and abdominal fat. Plucked weight and dressed weight were significantly highest for birds fed 2 and 4 g/kg dietary turmeric. This disagrees with reports of Mehala and Moorthy (2008) and **Nouzarian *et al.* (2011) that** turmeric application as feed additive up to 10g/kg dietary inclusion of had no significant impact on carcass percentage of broiler chickens. This reason behind this may be due to some factors stated by Sasikumar (2005), that soil factors, feed nutrient, level of acidity as well as the genus diversity, may affect the content of curcumin in turmeric. Kawamori *et al.* (1999) stated that p-tolymethylcarbinol, a turmeric component, can increase gastrin, secretin, bicarbonate, and pancreatic enzyme secretion, contributing to protein accretion (buildup) and weight of cut up parts. Concurrently, cayenne pepper is high fibre. Coarse particles may however slow the passage rate of digestion to the gizzard (Nir *et al.*, 1994), thereby increasing the exposure time of nutrients to digestive enzymes in the proventriculus, which in turn may improve energy utilization and nutrient digestibility (Carre, 2000). The result of cut-up parts was also significant, with thigh weight highest at 2g/kg turmeric inclusion. This is contrary to what was stated by Basavaraj *et al.* (2011) and Durrani *et al.* (2006) that only at 5g/kg did turmeric improve the dressing percent of birds, increased breast weight and mean thigh weight. This could be attributed to the cultivar of turmeric and broiler strain used as feather formation of broiler chicken differs in feather yield and overall carcass weight. Drumstick was best influenced in groups fed 4g/kg tur + 1g/kg cay additive, which possibly suggests optimum antioxidant activity of turmeric at 4g/kg fed broiler chickens. This is similar to result obtained by Durrani *et al.* (2006) who observed that dietary inclusion of turmeric at 5g/kg stimulated protein synthesis by bird enzymatic system.

Conclusion

Broiler chickens fed 2g/kg turmeric and 2g/kg cayenne pepper diet had the highest dressed percentages, while thigh percentage was significantly best in groups fed 2g/kg turmeric and 1g/kg cayenne. Therefore, inclusion of turmeric at 2g/kg should in diets improves dressed percentage of broiler chickens.

References

Basavaraj, M., V. Nagabhushana, N. Prakash, M. M. Appannavar, P. Wagmare and S. Mallikarjunappa. 2011. Effect of dietary supplementation of *Curcuma Longa* on the biochemical profile and meat characteristics of broiler rabbits under summer stress. *Veterinary World.* 4:15-18

Cahaner A., Nitsan, Z., Ni, I. 1986. Weight and fat content of adipose and on adipose tissue in broilers selected for and against abdominal adipose tissue. *Poultry Science Journal* 65: 215-222.

Carre, B. 2005. Effets de la taille des particules alimentaires sur les processus digestifs chez les oiseaux d'elevage. *INRA Prod. Anim.* 13: 131-136.

IBM Corporation Released 2011. IBM SPSS, Statistics for Windows, Version 20.0. Armonk, New York: IBM, Corporation SPSS.

McCarthy, T. L., Kerry, J. P. Kerry, J. F. Lynch, P. B. Buckley, D. J. 2001. Evaluation of the antioxidant potential of natural food/plant extracts as compared with synthetic antioxidants and vitamin E in raw and cooked pork patties. *Meat Science*, 57: 45-52.

Mehala, C and. Moorthy, M. 2008. Production performance of broilers feed with Aloe vera and *Curcuma longa* (Turmeric). *International Journal of Poultry Science*, 7(9):852-856.

Grubben, J. H., Tahir, I. M., Denton, O. A. 2004. Capsicum species. In: Plant Resources of Tropical Africa. 2nd(Eds.)., PROTA Foundation, Wageningen, Netherlands, Backhugs Publishers, Leiden, Netherlands, pp: 154-163.

Mondal, M. A., Yeasmin, T., Karim, R., Nurealam Siddiqui M., Raihanun-Nabi S.M., Sayed M. 2015 Powder on the growth performance and carcass traits of broiler chicks. South Asian Association for Regional Cooperation *Journal of Agriculture, 13(1):188-199*

Nir, I., Hilliel, R.., Shefet, G., Nitsan Z. 1994. Effect of grain particle size on performance. 2. Grain texture interactions. *Poultry Science* 73: 781-791

Ogunlade. I., Alebiosu. A. A. and Osasona. A. I. 2012. Proximate, mineral composition, antioxidant activity and total phenotic content of some pepper varieties. *International Journal of Biological and Chemical Sciences, 6 (8)*: 2221–2227.

Osawa, T., Sugiyama, Y., Inayoshi, M., and Kawakishi, S. 1995. Antioxidative activity of tetrahydrocurcuminoids. *Bioscience, Biotechnology and Biochemistry*, 59:1609-1612.

Sasikumar, B., Syamkumar, S., Remya, R., Zachariah T. J. 2005. PCR based detection of adulteration in the market samples of turmeric. *Jornal of Food Biotechnology* 18 (3): 299-306

Table 1: Effect of Feed Composition on Carcass yield of Broiler Chicken

Parameters	Control (C)	C+200t	C+400t	C+100c	C+200c	C+200t+100 c	C+400t+100 c	C+200t+200 c	C+400t+200c	SEM
Live weight (g)	1508.33^{ab}	1566.67^{ab}	1583.33^{ab}	1555.00^{ab}	1500.00^{b}	1603.33^{a}	1575.00^{ab}	1533.33^{ab}	1583.33^{ab}	29.75
Carcass Yield										
Plucked weight (g)	1218.00^{b}	1391.67^{a}	1420.00^{a}	1405.00^{ab}	1328.33^{ab}	1366.67^{ab}	1308.33^{ab}	1290.00^{ab}	1366.67^{ab}	51.10
Eviscerated weight (g)	1040.33^{b}	1173.33^{a}	1157.67^{a}	1142.00^{ab}	1100.00^{ab}	1110.67^{ab}	1040.00^{b}	1143.33^{ab}	1113.33^{ab}	34.37
Dressed weight	900.33^{c}	1080.00^{a}	984.00^{abc}	1040.00^{bc}	1000.00^{bc}	1022.00^{ab}	1022.00^{ab}	925.67^{bc}	984.67^{abc}	35.06
Dressed (%)	59.69^{c}	68.94^{a}	64.55^{abc}	62.14^{abc}	68.60^{a}	63.74^{abc}	64.89^{ab}	60.37^{bc}	62.19^{abc}	2.10
Cut-up parts										
Head (%)	3.29	3.04	2.77	3.00	3.06	2.94	3.14	2.97	2.94	0.20
Shank (%)	4.93	4.95	4.50	4.84	4.90	4.65	5.45	4.66	4.93	0.34
Neck (%)	5.74^{a}	4.98^{bc}	4.46^{c}	4.57^{c}	4.92^{bc}	4.94^{bc}	5.14^{abc}	5.29^{ab}	5.09^{abc}	0.21
Thigh (%)	10.4^{ab}	11.16^{a}	8.38^{b}	11.11^{a}	10.32^{ab}	10.20^{ab}	11.12^{a}	10.67^{ab}	8.68^{ab}	0.74
Breast (%)	16.81	17.11	16.84	16.86	17.19	16.44	14.51	16.25	15.20	1.41
Back (%)	13.31	13.69	13.22	13.81	15.26	14.07	15.06	13.36	13.09	0.66
Wings (%)	7.98	7.61	7.13	7.94	7.92	7.68	8.12	7.29	7.54	0.29
Drumstick (%)	10.17^{ab}	9.76^{ab}	8.94^{b}	9.13^{b}	10.68^{ab}	10.22^{b}	11.22^{a}	10.11^{ab}	10.83^{ab}	0.61
Internal Organs										
Heart (%)	0.39^{b}	0.41^{ab}	0.42^{ab}	0.36^{b}	0.39^{ab}	0.43^{ab}	0.48^{ab}	0.50^{a}	0.45^{ab}	0.04
Kidney (%)	0.16^{c}	0.16^{bc}	0.23^{ab}	0.17^{bc}	0.22^{abc}	0.18^{abc}	0.18^{abc}	0.20^{abc}	0.24^{a}	0.02
Liver (%)	2.11^{b}	2.59^{a}	2.47^{ab}	2.42^{ab}	2.63^{a}	2.05^{b}	2.08^{b}	2.44^{ab}	2.4^{ab}	0.14
Lungs (%)	0.44^{b}	0.50^{ab}	0.65^{a}	0.46^{b}	0.41^{b}	0.46^{b}	0.51^{ab}	0.46^{b}	0.51^{ab}	0.05
Gizzard (%)	2.25^{b}	2.23^{b}	1.86^{b}	2.22^{b}	1.99^{b}	1.85^{b}	2.22^{b}	1.99^{b}	2.98^{a}	0.16
Spleen (%)	0.16	0.15	0.14	0.15^{ab}	0.17	0.13	0.14	0.17	0.13	0.01
Small Intestine (%)	0.30^{a}	0.25^{b}	0.26^{ab}	0.29^{ab}	0.27^{ab}	0.25^{b}	0.27^{ab}	0.26^{ab}	0.25^{b}	0.01
Large Intestine (%)	8.08^{abc}	8.25^{abc}	8.14^{abc}	8.07^{ab}	9.00^{a}	7.87^{bc}	7.87^{bc}	8.27^{abc}	7.54^{b}	0.295
Caecum (%)	1.55^{ab}	1.37^{ab}	1.31^{b}	1.30^{b}	1.71^{a}	1.28^{b}	1.51^{ab}	1.4^{ab}	1.42^{ab}	0.10
Abdominal Fat	12.50	21.00	19.00	15.25	11.00	15.55	15.10	14.45	16.10	3.26

^{a,b,c} Means in the same row with different superscripts differ significantly ($p<0.05$)

t – turmeric rhizome powder, c- Cayenne Pepper