PERFORMANCE OF BROILER CHICKENS ADMINISTERED GRADED LEVELS OF BITTER KOLA (*GARCINIA KOLA*, HECKEL) AS FEED ADDITIVE

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Abstract

A study of 28 days (4 weeks) was carried out at the Poultry Section of Rivers State University, Nkpolu-Oroworukwo, Port-Harcourt Rivers State-Nigeria, to determine the effect of bitter kola *(Garcinia kola,* Heckel*)* powder as a growth promoter in broiler chicken diets. One hundred and forty-four (144) unsexed day-old Anak strain broiler chicks were subjected to various concentrated levels of bitter kola at T_1 (control), T_2 (5g/kg feed), T_3 (10g/kg feed), T_4 (15g/kg feed) respectively using a Completely Randomized Design (CRD), with 36 birds/treatment and 12 birds/replicate. The parameters evaluated were weight gain, feed intake, feed conversion ratio and cost production. Data collected were subjected to Analysis of Variance (ANOVA). Results obtained indicated significant effect ($P<0.05$) in all the growth parameters evaluated. Although the best production such as reduced feed intake, improve growth rate, feed conversion ratio and cost of production, were recorded in birds administered 15g bitter kola /kg feed, however all the treated groups presented better results over the T_1 (control). It was therefore advocated that bitter kola should be included in broiler diets as a feed additive to improve broiler chickens performance.

Keywords: Bitter kola, Broiler chicken, Feed intake, Weight gain, Production cost

Introduction

Bitter kola (*Garcinia kola,* Heckel) tree belongs to the botanical family of *Guttiferae* (Plowden, 1992). It is a medium-sized rain forest tree crop, well cultivated through West Indies, West and Central Africa (Iwu *et al.*, 1990). The bitter kola fruit is used as food and herbal medicine and produces reddish, yellowish or orange seeds when ripe, containing two to four seeds. Each fruit contains about 6-8 smooth elliptically shaped seeds with brown coat. Bitter kola (*Garcinia spp*) is known to have an elaborate complex mixture of phenolic compounds including bioflavonoids, xanthones and benzophenones (Iwu *et al.*, 1990). Adegboye *et al.*, (2008) tested for the presence of alkaloids, steroids, cardiac glycosides, flavonoids, tannins, saponins and reducing sugar in bitter kola. All the phytochemical compounds tested for were found present except alkaloids. Also bitter kola was reported to contain in g/100g tannin- 0.342 ± 0.00, oxalate- 0.423 ± 0.00g, phytate- 0.570 ± 0.05, trypsin inhibitor- 0.370 ± 0.12, phenol- 0.147±0.00, saponin- 2.471 ± 0.00, alkaloids- 0.647 ± 0.20, flavonoids 2.041 ± 0.30 and glycosides 3.421 ± 0.00 (Adesuyi *et al.*, 2012). The major active constituents (alkaloids and flavonoids) of bitter kola were reported to stimulate an increase in gastric acid secretion (Oluwole and Obtatomi, 1991). Bitter kola was reported to contain 0.58% crude protein, 0.10% crude fibre, 3% ether extract, 5% crude ash and 72.72% nitrogen free extract (Ibekwe and Orok, 2010). Odebunmi *et al.*, (2009) reported fresh bitter kola to have 39.52 ± 0.06% dry matter, 4.51 ± 0.56% crude fat, 2.48 + 0.10%, crude protein, 0.79 ± 0.005% ash, 5.23 ± 0.16% crude fibre and 35.64% total carbohydrates. The following mineral compositions from bitter kola were also reported in mg/Kg: K -722.10 ± 0.00, Ca- 67.07 ± 0.12, Mg- 114.83 ± 3.47, Fe- 6.10 ± 0.43, Zn- 2.30 ± 0.08, Mn- not detectable, P-188.57 ± 0.37 (Odebunmi *et al.*, 2009). Adesuyi *et al.*, (2012) also reported the following proximate chemical composition for bitter kola: moisture content- 7.2 ± 0.08%, crude protein- 1.86 ± 0.15%, crude fibre- 1.23 ± 0.15%, ash- 0.47 ± 0.09%, crude fat- 0.19 ± 0.32%, carbohydrate- 88.30 ± 0.08%. *Garcinia kola* increases the activities of the enzymes lactate dehydrogenase and glucose -6- phosphate dehydrogenase (www.wikipedia.com/*Garcinia kola*). Therefore this study investigated the effect of bitter kola as feed additive in a broiler diets at different graded level.

Materials and Methods

The experiment was carried out at the poultry production section of Teaching and Research farm of the Rivers State University, Rivers state Nigeria.
The fresh bitter kola seeds were purchased from a local market (Oil mill) Rumuchorlu in Obio/Akpor Local Government Area of Rivers State- Nigeria. Bitter kola seeds were sliced, and air dried. The soft brown testa was then removed before grinding into powdered form. It was incorporated into top feed finisher feed with protein content of 18% and energy content of 2900 Kcal/kg ME. One hundred and forty-four (144) unsexed day-old broiler chicks were allocated randomly to pens. The breed used for this experiment was of Anak Strain sourced from Zartech Hatchery in Oyo State. Water and feed were *ad-libitum* with routine vaccinations and medications administered strictly during the study. Powdered bitter kola was incorporated into proprietary broiler finisher mashes at graded levels with 0g bitter kola /kg of feed which served as control while treatments 1,2, and 3 had 5g/kg, 10g/kg and 15g/kg of feed respectively as diet inclusions. There were four treatments with three replications, each treatment had thirty six (36) birds with twelve (12) birds in each replicate distributed into twelve (12) pens and well tagged according to treatment. The design of the experiment was Completely Randomized Design (CRD). The study lasted for 28 days (4 weeks At the onset of the experiment mean initial body weight of the birds were measured and recorded. Mortality was recorded as it occurred. The parameters evaluated were weight gain, feed intake, feed conversion ratio and cost of feed consumed. Feed intake was measured on daily basis and obtained by subtracting the left-over from the feed given; the sum total was done every week. The birds were weighed in groups to determine the body weight. Weight gain was obtained by subtracting the initial weight from the final weight. The feed conversion ratio was measured as total feed intake over total weight gain. The data collected were subjected to Analysis of Variance (ANOVA), (Steel and Torrie, 1980) and the differences between treatment means where they existed were separated using Duncan's New Multiple Range Test (DNMRT).

Results and Discussion

The effect of bitter kola (*Garcinia kola,* Heckel) as a growth promoter on broiler chickens are presented in the **Table1** below**.** The results obtained showed that significant differences ($P<0.05$) existed in all the parameters measured in relation to final body weight, body weight gain, and feed conversion ratio and no significant differences ($P>0.05$) existed in feed intake. The mean final body weights for the birds were 2.65kg, 2.80kg, 2.85kg and 3.00kg respectively for T_1 (control), T_2, T_3 and T_4 respectively. The highest final weight was recorded in T_4 and was least in T_1 which is the control with comparable final weights in T_2 and T_3. The mean total body weight gain for the birds were 2.57kg, 2.72kg, 2.77 kg and 2.91kg respectively for T_1 (control), T_2, T_3 and T_4. The highest mean total body weight gain was recorded in T_4 (15g/kg) and was least in T_1 (control), while comparable weight gains were observed in T_2, T_3. The results on mean total feed intake showed no significant ($P>0.05$) difference between the control and the treated groups and were observed as 12.00kg, 11.85kg, 12.50kg and 11.55kg respectively for T_1 (control), T_2, T_3 and T_4. The highest feed intake was recorded in T_3 (10g/kg) while the least was observed in T_4 (15g/kg) and T_2 (5g/kg) respectively. Feed conversion ratio (feed intake/weight gain) was superior in T_4 (15g/kg) and the least feed conversion ratio was observed in the T_1 (control). Data on feed conversion ratio ranged from 3.97- 4.67. The results on the cost of feed showed that T_1 (control), T_2, T_3, T_4 recorded ₦1248.00, ₦1235.25, ₦1305.70 and ₦1209.75 respectively. This showed that T_4 (15g/kg) had the least cost of production while the highest cost of feed production was recorded in T_3 (10g/kg). This equally reflected in the total feed consumed.
The results from this experiment indicated that broilers had better growth performance potentials in terms of final weight, weight gain, feed intake, feed conversion ratio and feed cost of production when dried bitter kola was added to the proprietary feed as a feed additive at 15g/kg level over the control for 28 days (4 weeks). Reported literature has suggested that plant materials enhance the secretion of endogenous digestive enzymes and activate the immune response and antioxidant activities (Jamroz *et al.*, 2003).

Table 1: The effect of Bitter kola *(Garcinia kola,* Heckel*)* on the Performance Characteristics of Broiler Chickens

Parameters	Treatment				
	T_1 Og/kg(control)	T_2(5g/kg)	T_3(10g/kg)	T_4(15g/kg	SEM
Mean initial weight (kg)	0.87	0.83	0.85	0.81	-
Mean final weight (kg)	2.65^{c}	2.80^{bc}	2.85^{b}	3.00^{a}	0.06
Mean total weight gain (kg)	2.57^{c}	2.72^{bc}	2.77^{b}	2.91^{a}	0.04
Mean daily weight gain (g)	91.79^{c}	97.14^{bc}	98.93^{b}	103.93^{a}	0.86
Mean total feed intake (kg)	12.00	11.85	12.50	11.55	0.13
Mean daily feed intake (g)	428.60	423.20	446.40	412.50	2.05
Feed conversion ratio	4.67	4.36	4.51	3.97	0.05
Cost of feed without B. kola/Kg (₦)	1248.00	1232.40	1300.00	1201.20	-
Cost of feed with B. kola/Kg (₦)	1248.00	1266.17	1371.25	1299.95	-
Mortality	3	0	1	2	0

^{abc} *Means within a row with different superscripts differ significantly at (P < 0.05).*
SEM: Standard Error mean

Also better feed conversion ratio obtained from broilers fed dried bitter kola diet could be compared with the work of Adedeji *et al*., (2006) who obtained highest (P<0.05) feed efficiency from broiler chicks fed 25g per Kg diet dried bitter kola over other broilers without bitter kola in their diets.
In addition the better weight gain obtained from broilers fed dried bitter kola in this study could be compared with the work of Dada and Ikuerowo (2009) who reported that fish fed 1g/kg diet ethalonic extract of bitter kola had best (P<0.05) weight gain than those fed the control diet and those fed 0.25, 0.5 and 2g/kg diet ethanolic extract of bitter kola. This result is contrary to the result obtained in this study possibly because in this study the bitter kola seed powder was used rather than the extract, the amount of the bitter kola administered to the animals coupled with the variation in the species of the animals also differs. On the other hand, enhanced growth performance was also reported in poultry (Adedeji *et al*., 2006) and rats (Oluyemi *et al*., 2007) fed diets containing bitter kola extracts. All the mortalities that occurred in this study could not be related to any specific cause, as such were assumed to have occurred by chance. The study reported appeared to justify the addition of bitter kola in broiler diets.

Conclusion

Though, the possible mode of action of bitter kola was not explored in this study, it is concluded that air dried grounded bitter kola must have some active components that might have enhanced the physiology of the birds that fed on it to give them their superior performances. Also, 5-15g bitter kola/Kg feed can be used in broiler finisher diets in order to have improved final weight, weight gain, feed intake, feed conversion ratio and better cost feed production. Further research should be conducted to explore the possible mode of action of 5-15g bitter kola/Kg feed on the physiology of broiler birds as it would serve as useful information for feed resources and nutrition.

References

Adedeji, O. S., Farinu, G. O., Ameen, S. A., & Olayeni, T. B. (2006). The effects of dietary bitter kola (Garcinia kola) Inclusion on body weight, haematology and survival rate of pullets chicks. *J. Anim. Vet. Adv.*, *5*(3), 184-187. Retrieved from http://medwelljournals.com/abstract/?doi=javaa.2006.184.187.

Adegboye, M . F; Akinpelu, D. A., and Okoh, A. I. (2008). The bioactive and phytochemical properties of *Garcinia kola* (Heckel) seed extract on some pathogens. *African Journal of Biotechnology* Vol. 7 (21), pp. 3934-3938. Retrieved from http://www.academicjournals.org/AJB. http://dx.doi.org/10.5897/AJB08.586.

Adesuyi, A.O; Elumm, I. K; Adaramola, F. B.; and Nwokocha, A .G. M. (2012). Nutritional and Phytochemical Screening of *Garcinia kola. Advance Journal of Food Science and Technology, s4*(1), 9-14.

Ibekwe, H .A. and Orok, E .E. (2010). Proximate Composition of *Aframomum Melegueta* Seeds, *Garcinia kola* Seeds and Growth Performance of Broiler Chicks treated with Powders from these Seeds. *International Journal of Poultry Scienc*e, *9*(12), 1152-1155.

Iwu, M .M.; Igboko, A .O., and Tempesta, M. S. (1990). Antidiabetic and aldose reductase activities of biflavanones of *Garcinia kola. Fitoterapia*, LXi(1), 178.

Jamroz, D.; J. Orda; C. Kamel; A. Wilicz-Kiewicz, T. Wertelccki and J. Skorupinska (2003). The influence of phytogenetic extracts on performance, nutrient digestibility, carcass characteristics and gut microbial status in broiler chickens. *J. Ani. Feed-Sci.*, 12:583-596.

Odebunmi, E. O.; Oluwaniyi, O .O.; Awolola, G .V., and Adediji, O .D. (2009). Proximate and nutritional composition of kola nut (*Cola nitida*), bitter cola (*Garcinia cola*) and alligator pepper (*Afromomum melegueta*). *African Journal of Biotechnology*, *8*(2), 308-310. http://www.academicjournals.org/AJB

Oluyemi, A .K., Omotuyi, O. I., Jimoh, R .O., Adesanya, A. O., Saalu, C. L., & Josiah, L. S (2007). *Biotechnol. Appl. Biochem, 46,* 69 -72.

Oluwole, F .S., and Obtatomi, A .B (1991). The effect of Garcinia kola seed on Gastric acid secretion in albino rats. *Nig. J. Physio Sci, 8,* 75-80.

Plowden, C. C. (1992). *A manual of plants names 3rd edition*., London geroge Ltd. Pp 239.

Steel, R. G. D. and Torrie J. H. (1980). *Principles and procedures of Statistics* . A biometric Approach. 2nd Ed. Mc Graw-Hill Book Co.