

Haematological, serum and carcass characteristics of broiler chicken fed `graded levels of *Garcinia kola* (Bitter kola) used as phytobiotic

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Abstract

The study was conducted to evaluate the effect of Garcinia Kola (Bitter Kola) used as phytobiotic or herbal natural additives on biochemical and carcass characteristics of broiler chickens. Five diets with different levels of inclusion of the kola were fed to a total of 150 Marshal day- old broilers. There were three replicates of ten birds per replicate. The five diets were made of control diet; diets 2, 3, 4 and 5 had 500ppm, 1000ppm, 1500ppm and 2000ppm of G. Kola respectively. The feeding trial lasted for eight weeks. Data were analyzed using completely randomized design. The results of haematological parameters examined show that there were significant (P<0.05) differences in all the haematological indices measured, the values however, did not follow any particular pattern. Highest haemoglobin, packed cell volume (PCV) and red blood cells (RBC) values were recorded for birds on 1500ppm compared to other birds with values ranging between 8.40-10.00, 25.00-29.50 and 2.47-2.77 for Hb, PCV and RBC respectively. The least haemoglobin and PCV values were recorded in diet containing 2000ppm. Dietary supplementation of G. kola revealed significant (P<0.05) effects in the values of albumin and serum aspartate aminotransferase (SAST) with fluctuating values. The albumin level increased from 0ppm to 1500ppm G. kola inclusion levels and later dropped at 2000ppm inclusion level. Birds fed bitter kola had higher values SAST than the control group. Results of carcass analysis study revealed significant (P<0.05) differences in the values obtained for live weight, dressed weight and dressing percentage. Birds fed with 0ppm of Garcinia kola had the highest live weight (2066.70g) while those on 1500ppm had the lowest. The same trend was observed in the mean values obtained for dressed weight. There were no significant differences (P>0.05) for all the organ weights observed except kidney which was found to show improvement with increased bitter kola level. It was concluded that dietary supplementation of broiler chicken with bitter kola produced haematological and carcass results that did not follow any definite pattern.

Key word: Garcinia kola, haematology, serum, carcass, broiler chicken, phytobiotic

Introduction

For the past several decades due to intensifications of production, a variety of non nutritive feed additives have been used in poultry production to improve the overall performance of birds. Antibiotics growth promoters (AGP) have been included in poultry diets to promote growth, health and to maximize the genetic potentials of

modern poultry (Bozkurt *et al*., 2008). However, the presence of residue of antibiotics in meat and meat products meant for human consumption and the development of drug resistant micro organisms in human has brought about the search for alternative plant extract as antibiotics and growth promoters (Denli *et al*., 2003). Researchers (Dorman and Deans, 2000; Kamel, 2001; Tucker, 2002; Cross *et al.*, 2003; Lewis *et al.,* 2003) have identified several beneficial chemical compounds in medicinal plants which play an important role in improving production and immune system of birds against diseases and have strong medicinal value and could be effectively utilized as natural growth promoters to replace antibiotics and other synthetic feed additives. The environment of man is endowed with plants and fruits which over time have been found to be of great nutritional and health importance to man and animal. Such plants and fruits constitute sources of spices in food, stimulants and some micronutrients while others may have aphrodisiac properties. These plants or spices and fruits includes *Allium sativum* (garlic), *Zingiber officinale* (ginger), *Piper nigrum* (pepper) eggplant (*Solanum Species)* and *Garcinia* kola, many of which have been extensively investigated and their properties documented (Adeleye and Ayejuyo, 1994; Ali *et al.,* 2000). Quite a number of these plant materials mentioned above have antimicrobial properties with tremendous therapeutic potentials (Cowan, 1999; Chatterjee, 2000). *Garcinia kola* nut, generally known as *Bitter kola* in Nigeria belongs to a family of tropical plants known as Guttifera (Plowden, 1992). *G. kola* is found in moist forest and grows as a medium size tree, up to 12 m high. It is cultivated and distributed throughout west and central Africa. It is commonly called "*Namijin goro*" in *Hausa, Orogbo* in *Yoruba* and "*Agbilu*" in *Igbo* . *Garcinia kola* Heckel (*G. kola*; Guttiferae) is a dicotyledonous plant found in the rain forests of Central and West Africa. It is grown on homesteads in Southern Nigeria; a detailed description and distribution of the plant have been documented (Iwu, 1993) . *G. kola* nuts are used in traditional medicine for various ailments such as sore throat and arrow "poisoning". Other medicinal uses include its use as purgative, anti-parasitic, anti-microbial, anti-viral, anti-inflamatory, antidote to the effects of *Strophantus gratus*, remedy for guinea-worm infection and for the treatment of gastroenteritis, rheumatism, asthma, menstrual cramps, bronchitis, throat infections, cure headache, relieve colic, chest colds, cough, and liver disorders (Iwu, 1985; Iwu *et al*., 1987; Iwu *et al*., 1990). The plant is also used as anti-diabetic, antioxidant, and for the chemoprevention of aflatoxin B1 and anti-hepatotoxic activities (Ajani *et al*., 2007; Farombi *et al* . ,2005; Tita *et al*., 2001). Based on these medicinal properties, an experiment was therefore, carried out to investigate the serum, haematology and carcass evaluation of broilers chicken fed varied levels of *Garcinia kola.*

Materials and Methods

The research was carried out at the Poultry unit of the Teaching and Research Farm Directorate, Federal University of Agriculture, Abeokuta, Nigeria, West Africa. The area is located 76 m above sea level and falls within latitude 7°15'north and longitude 3°21' east. Mean annual temperature and humidity are 34.7^{0}C and 82% respectively. Seasonal distribution of rainfall is approximately 44.96mm in the late dry season (January-March), 212.4mm in the early wet season (April-June), 259.3mm in the late wet season (July-

September) and 48.1mm in the early dry season (October-December). *Garcinia kola seeds were* purchased at Ogunmakin market in Ogun State, Nigeria. The seeds were peeled and sliced into pieces to increase surface area for drying. It was sun-dried for 7 days, after which it was ground into powdery form, kept in an air tight container until when needed.

Management of experimental birds and diet

Standard broiler rations (starter and finisher diets) were formulated and fed as control diets containing 0ppm; *G. kola* was added to diets 2, 3, 4 and 5 at the rate of 500ppm, 1000ppm, 1500ppm and 2000ppm respectively (Tables 1 and 2). One hundred and fifty (150) unsexed day - old Marshal Strain of broiler chicks purchased from a local commercial hatchery were randomly allotted to the five dietary treatment groups in a completely randomized design. Each group contained 30 birds divided into three replicates of 10 birds each. The birds were vaccinated against diseases endemic in the area. Heat was supplied during the brooding stage using charcoal pot; temperature was kept at 32^0 C for the first week, 28^0 C for the second week. Wood shavings were used as litter materials at a depth of about 5cm. Feed and water were provided *ad-libitum.*

Haematological and Serum analyses

At 8th week of the experiment, blood sample (2ml each) was collected from 30 broiler chickens (6 broilers per treatment) by vein puncture of wing. 2ml was collected from a bird per replicate into bottle containing Ethylene Diamine Tetra Acetate (EDTA), anti coagulant and another 2ml was collected into a hypothermic syringe, the blood in the bottle containing EDTA was used to determine haematological parameters (PCV, Hb, RBC, WBC), while those collected using hypothermic syringe were used to determine serum parameters (serum total protein, albumin, globulin, glucose, creatinine and uric acid). Tubes containing blood samples for haematological measurement were placed in refrigerator (4^0C) immediately while the other sets meant for serum biochemistry measurement were placed in an ice bath and transported to the laboratory. Haemoglobin concentration was estimated using the cyanmethaemoglobin method (Cartwright, 1968). The packed cell volume (PCV), red blood cell (RBC) and white blood cell (WBC) were determined was determined by methods outlined by Schalm *et al.* (1975). Plasma samples were analyzed for total proteins, albumin, globulin, uric acid, creatinine, and serum alanine aminotransferase (SALT) and serum aspartate aminotransferase (SAST) levels. The serum biochemical indices were carried out using routine standard clinical chemistry procedures (Olorede *et al*., 1996). The enzymatic colorimetric test (GOD-POD) was employed in the determination of the blood glucose level as described by Sobayo (2005).

Carcass measurement

At the end of the 8th week, two (2) birds per

Table 1: Proximate composition of *Garcinia kola*

Parameters	%
Moisture (%)	47.49
Dry matter (%)	52.51
Crude protein (%)	1.49
Ether extract (%)	3.86
Ash (%)	2.64
Crude fibre (%)	2.67
Nitrogen free extract	41.85

Proximate fractions are on a Dry Matter basis.

Table 2: Composition of experimental diet for Broiler Starter (0-4weeks)

	Levels of *Garcinia kola*				
Ingredients (%)	**0ppm**	**500ppm**	**1000ppm**	**1500ppm**	**2000ppm**
Maize	50.00	50.00	50.00	50.00	50.00
Soya bean meal	18.00	18.00	18.00	18.00	18.00
Groundnut cake	14.00	14.00	14.00	14.00	14.00
Fish meal	3.00	3.00	3.00	3.00	3.00
Wheat offal	8.00	8.00	8.00	8.00	8.00
Palm kernel meal	2.50	2.50	2.50	2.50	2.50
Bone meal	2.30	2.30	2.30	2.30	2.30
Lime stone	1.50	1.50	1.50	1.50	1.50
Premix*	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25
Lysine	0.10	0.10	0.10	0.10	0.10
Methionine	0.10	0.10	0.10	0.10	0.10
Bitter kola	-	+	++	+++	++++
Total	100	100	100	100	100
Determined analysis					
Crude protein %	22.00	22.00	22.00	22.00	22.00
ME (MJ/kg)	12.21	12.21	12.21	12.21	12.21
Phosphorus %	0.44	0.44	0.44	0.44	0.44
Calcium %	0.17	0.17	0.17	0.17	0.17
Crude fibre %	3.61	3.61	3.61	3.61	3.61
Ether extract	4.47	4.47	4.47	4.47	4.47
Lysine	1.03	1.03	1.03	1.03	1.03

*Vitamin-mineral premix (2.5kg/1000kg); vitamin A (10,000,000IU), vitamin D3(3,000,000IU), vitamin E (30,000IU), vitamin K (2.3gm), vitamin B1 (2.0gm), Riboflavin (5.0gr), Pyridoxine (3.0gm), vitamin B12 (160mg), Biotin (60mg), Niacin (31gm), panthotenic acid (8gm), folic acid (1gm),manganese (85gm), zinc (50gm), iron (25gm), copper (6gm), iodine (1gm), selenium (120gm), cobalt (220mg),antioxidant (125gm), choline chloride (200gm).

replicate were selected randomly with their live weights taken before carcass evaluation. The birds were slaughtered by severing their jugular veins with sharp surgical knife. The birds were then soak in hot water (scalding), defeathered and washed. The internal contents were neatly removed and weighed (evisceration) followed by the cutting of the carcass into retail parts and weighed. Dressing weight was recorded after evisceration. The weights were expressed as percentages of live weights.

Statistical analysis

Data obtained were subjected to One Way Analysis of Variance using SAS (2001) while difference between means was determined by Duncan Multiple Range Test (Duncan, 1995).

Results and Discussion

The results of haematological parameters examined are presented in Table 4. There were significant ($P<0.05$) differences in all the haematological indices measured, the values however, did not follow any particular pattern. Highest haemoglobin, packed cell volume and red blood cells values were recorded for birds on 1500ppm compared to other birds with values ranging between 8.40-10.00, 25.00-29.50 and 2.47-2.77 for Hb, PCV and RBC respectively. The least haemoglobin and PCV values

Table 3: Composition of experimental diet for Broiler finisher (4-8weeks)

	Levels of Garcinia kola				
Ingredients (%)	**0ppm**	**500ppm**	**1000ppm**	**1500ppm**	**2000ppm**
Maize	52.00	52.00	52.00	52.00	52.00
Soya bean meal	10.00	10.00	10.00	10.00	10.00
Groundnut cake	15.00	15.00	15.00	15.00	15.00
Fish meal	1.50	1.50	1.50	1.50	1.50
Wheat offal	12.00	12.00	12.00	12.00	12.00
Palm kernel meal	5.00	5.00	5.00	5.00	5.00
Bone meal	2.30	2.30	2.30	2.30	2.30
Lime stone	1.50	1.50	1.50	1.50	1.50
Premix *	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25
Lysine	0.10	0.10	0.10	0.10	0.10
Methionine	0.10	0.10	0.10	0.10	0.10
Bitter kola	-	+	++	+++	++++
Total	100	100	100	100	100
Determined Analysis					
Crude protein %	19.00	19.00	19.00	19.00	19.00
ME (MJ/kg)	11.76	11.76	11.76	11.76	11.76
Crude Fibre	3.35	3.35	3.35	3.35	3.35
Ether Extract	4.49	4.49	4.49	4.49	4.49
Calcium	1.33	1.33	1.33	1.33	1.33
Phosphorus	0.12	0.12	0.12	0.12	0.12
Lysine	1.15	1.15	1.15	1.15	1.15

*Vitamin-mineral premix (2.5kg/1000kg); vitamin A (11,000,000IU), vitamin D3 (3,000,000IU), vitamin E (30,000IU), vitamin K (2.3gm), vitamin B1 (1.7gm), Riboflavin (5.2gm), Pyridoxin (3.7gm), vitamin B12 (18mg), Biotin (76mg), Niacin (37gm), panthotenic acid (9.2gm), folic acid (0.9gm),manganese (85gm), zinc (50gm), iron (25gm), copper (6gm), iodine (1gm), selenium (120gm), cobalt (220mg),antioxidant (126gm), choline chloride (180gm)

were recorded in diet containing 2000ppm. This could be a pointer to poor diet utilization as haemoglobin values have been used as an assay of nutritional anaemia in livestock animals (Eggum, 1989). However, birds fed 2000ppm had the highest WBC value while those on 1000ppm supplementation had the lowest WBC value. The red blood cell (RBC) and packed cell volume (PCV) values obtained in this study fell within the normal range earlier reported (Mitruka and Rawnsley, 1977; Ross *et al*., 1978; Epelle, 1982 and Maxwell *et al*., 1990). Similarly, the

Table 4: Haematological parameters of broilers fed varying levels of bitter *kola*

Parameters	0ppm	500ppm	1000ppm	1500ppm	2000ppm	SEM
Haemoglobin (g/dl)	9.50^{ab}	8.90^{b}	9.50^{ab}	10.00^{a}	8.40^{b}	1.32
Packed cell volume (%)	28.00^{ab}	26.30^{b}	28.00^{ab}	29.50^{a}	25.00^{c}	2.14
White blood cell (x 10^{3})	31425^{ab}	28425^{b}	27700^{b}	30600^{ab}	33375^{a}	547.00
Red blood cell ($10^{12}mm^{3}$)	2.67^{ab}	2.47^{c}	2.57^{b}	2.77^{a}	2.50^{bc}	0.09

^{abc} Means the same row having different superscripts are significantly ($P<0.05$) different

Table 5: Serum chemistry of broiler birds fed varying levels of bitter kola

Parameter	0ppm	500ppm	1000ppm	1500ppm	2000ppm	SEM
Glucose (mg/dl)	200.10	205.70	215.20	167.75	180.60	5.09
Total protein (g/l)	63.35	69.20	69.90	67.10	61.30	2.94
Albumin (g/l)	39.15^{ab}	39.70^{ab}	42.55^{a}	40.00^{ab}	37.85^{b}	3.32
Globulin (g/l)	24.20	29.50	27.35	27.10	23.45	2.15
Creatinine (mg/dl)	1.00	0.93	0.93	0.93	0.97	0.02
Uric acid (mg/dl)	11.08	10.30	9.63	10.43	9.93	0.12
SALT (IU/L)	13.55	47.90	13.60	13.55	15.85	0.31
SAST (IU/L)	42.2^{c}	51.45^{bc}	55.50^{b}	60.60^{a}	57.70^{ab}	3.94

^{abc} Means the same row having different superscripts are significantly (P<0.05) different

haemoglobin concentration value is within the normal range reported by Mitruka and Rawnsley, 1977. Blood has been shown as an important index of physiological, pathological and nutritional status in the animals (Olorode *et al.*, 2007; Ewuola *et al.*, 2004). Reports by Aletor and Egberongbe (1992) and Aletor (1989) indicated that the blood variables most consistently affected by dietary factors includes RBC, PCV and Plasma protein.

Dietary supplementation of *G. kola* revealed significant (P<0.05) effects in the values of albumin and serum glutamate oxaloacetate transaminase (SAST) with fluctuating values as presented in Table 5. The albumin level increased as *G.kola* level increased from 0ppm to 1500ppm and later dropped at 2000ppm inclusion level. Birds fed bitter kola had higher values SAST than the control group. Meanwhile, Ekpenyong and Biobaku (1986) opined that the value of SAST and SALT are normally low in blood, but becomes high when there is an occurrence of liver damage by toxic substances. Birds fed *G. kola* based diets exhibited lower blood creatinine and uric acid levels which were not however, significant (P>0.05). The lower blood uric acid level observed in the *G.kola* treated birds could be due to the fact that amino acid composition of dietary treatments containing *Garcinia kola* was balanced. Imbalance amino acid in diets could cause elevated blood urea concentration (Eggum, 1970). Blood urea level most especially in monogastric animals is influenced by quantity, quality and proximity of the proceeding meal, which increases mostly after consumption.

The results of carcass characteristics of broilers fed varied levels of *Garcinia* kola is as presented in Table 6. Significant (P<0.05) differences were noticed in the values obtained for live weight, dressed weight and dressing percentage. Birds fed with 0ppm of *Garcinia* kola had the highest live weight (2066.70g) while those on 1500ppm had the lowest. The same trend was observed in the mean values obtained for dressed weight. The dressing percentage values obtained were higher than the range (57.28-58.59%) reported by Durrani *et al*. (2008), (69.80- 72.60%) reported by Longe (1986) and (78.80-75.26%) reported by Fanimo *et al*. (2007) when cashew nut testa was fed to broiler birds. Meanwhile, *Garcinia* kola has been reported to have limiting effect on the activity of some enzymes notably tyrosinase (Okunji *et al.,*

Table 6: Carcass Characteristics of broiler chicken fed diets supplemented with varying levels of bitter kola

Parameters	0ppm	500ppm	1000ppm	1500ppm	2000ppm	SEM
Live weight (g)	2066.70[a]	1700.00[ab]	1550.00[ab]	1350.00[b]	1533.33[ab]	717.20
Dress weight (g)	1903.30[a]	1456.70[ab]	1360.00[ab]	1203.30[b]	1336.70[b]	706.30
Eviscerated weight (g)	165.98	150.30	163.65	200.55	159.26	53.37
Dressing %	91.80[a]	85.63[b]	87.87[ab]	89.03[ab]	87.17[ab]	6.03
Breast %	17.60	15.63	16.30	24.33	16.77	12.52
Thigh %	10.12	9.35	10.37	16.10	9.70	7.05
Drumstick %	10.40	9.61	10.97	16.93	10.02	7.49
Wing %	9.29	7.55	9.81	15.55	9.34	10.38
Relative organ weight						
Heart %	0.43	0.53	0.49	0.81	0.57	0.41
Spleen %	0.09	0.14	0.13	0.12	0.16	0.07
Abdominal fat %	1.45	1.25	1.50	1.67	1.10	1.30
Lung %	0.45	0.51	0.57	1.68	0.56	1.56
Liver %	1.86	2.22	2.23	2.32	2.25	0.94
Kidney %	0.38[b]	0.59[ab]	0.37[b]	0.82[a]	0.62[ab]	0.51
Gizzard %	2.22	2.74	2.54	4.13	2.63	2.39
Proventriculus %	0.12	0.16	0.12	0.19	0.19	0.23

[ab] Means the same row having different superscripts are significantly (P<0.05) different

2007*)*. This may have slowed down the broiler birds' metabolic process hence the observed decrease in the final live weight and dressed weight values of the birds. The results of the relative organ weight of broilers shows that except for the values obtained for the kidney which ranged between 0.38g to 0.82g, there were no significant differences (P>0.05) for all the organ weights observed. The non significant change in liver, heart, gizzard, spleen, abdominal fat and lung reported in this study is in agreement with (Elangovan *et al*., 1996; Hernandez *et al*., 2004). Additionally, the non-significant (P>0.05) difference observed in the weight of heart among the treatment groups could be explained with observations of Hight and Barton (1965) in goats that the heart, being a vital organ attained most of its mature weight during foetal development.

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