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# The Effect of Bitter Kola (*Garcinia Kola* Heckel) Powder as Growth Promoter in Broiler Chickens Reared in Port Harcourt, Rivers State.

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**ABSTRACT**

**A study of 56 days (8 weeks) was carried out at the poultry section of Rivers State University of Science and Technology Nkpolu-Oroworukwo, Port-Harcourt Rivers State-Nigeria, to determine the effect of bitter kola *(Garcinia kola, Heckel)* powder as a growth promoter in broiler chickens. 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), $T_3$ (10g/kg), $T_4$ (15g/kg) respectively following a Completely Randomized Design (CRD), with 36 birds/treatment and 12 birds/replicate. At the end of the study, 3 birds were picked from each treatment, euthanized using chloroform and blood samples were collected for haematological assay. Major organs were excise and weighed, data collection were subjected to Analysis of Variance (ANOVA). Results obtained indicated significant effect ($P<0.05$) in all the growth and haematological indices measured. Although the best production and haematological indices such as reduced feed intake, improve growth rate, feed conversion ratio, Red Blood Cell, Haemoglobin, Packed Cell Volume and White Blood Cell were recorded in birds administered 15g/kg bitter kola, however all the treated groups presented better results over the control. It was therefore advocated that bitter kola should be included in broiler diets as a feed additive to improve their performance and digestibility.**

## 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 (Okunji and Iwu, 1991). It is an evergreen tree which can grow up to 30m high but usually up to about 12-15m. 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 is popularly called in major Nigerian languages as 'Namijingoro' in Hausa, 'Orogbo' in Yoruba and 'Agbilu' in Igbo. The seeds have bitter taste (Aluka, 1985). Bitter kola (*Garcinia spp*) is known to have an elaborate complex mixture of phenolic compounds including bioflavonoids, xanthones and benzophenones (Iwu *et al.,* 1990; Akpan *et al.,* 2008; Braide, 1993). The bioflavonoid possesses anti-inflammatory, anti-microbial, anti-viral and anti-diabetic properties (Adedeji *et al*., 2006; Afolabi *et al.,* 2006). 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. Other reports on phytochemical compounds isolated from bitter kola

include oleoresin (Adumoradi *et al.*, 2006; Onyade *et al.,* 1998), tannins, saponins, alkaloids, cardiac glycosides (Ebana *et al.,* 1991; Akpantah *et al.*, 2005). Biflavonoids such as kolaflavone and 2-hydroxybi-flavonols (Okunji and Iwu, 1991; Terashima *et al.,* 1999; Okunji *et al.*, 2002). 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 (Cross *et al.*, 2007; 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%. Bitter kola (*Garcinia kola,* Heckel) is traditionally used by African medical herbalists who believe that it has purgative, antiparasitic, anti-inflammatory, anti-viral and antimicrobial properties for the treatment of bronchitis, throat infections, colic, head or chest colds, coughs, eye pressure, diarrhoea, tuberculosis, improve lung function, impotence, knee osteoarthritis, liver disorders and scientific preliminary study research of the plant in the 1990s showed signs that it may benefit ebola victims by slowing down multiplication of the virus and also in animal studies, *Garcinia kola* increases the activities of the enzymes lactate dehydrogenase and glucose -6- phosphate dehydrogenase (www.wikipedia.com/*Garcinia kola*).

## MATERIALS AND METHODS

### Location of Study

The experiment was carried out at the poultry production section of Teaching and Research farm of the Rivers State University of Science and Technology, Nkpolu Oroworukwo, Port Harcourt. Rivers State lies between longitude $5^0$ 50'E and latitude $4^0$ 45'N and has a mean annual temperature of $26^0$C. Total annual rainfall is about 1700mm – 4700mm (Salawu *et al*., 1993).

### Source, Processing Method

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 (Fig. 1) with protein content of 18% and energy content of 2900 Kcal/kg ME.

### Experimental Birds

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. The chicks were brooded on deep litter using 200 watt bulbs and kerosene stoves. Water and feed were administered *ad-libitum* during the study.
Routine vaccinations and medications were strictly adhered to in the course of the study; standard sanitary management was also adhered to.

### Experimental design and data analysis

Powdered bitter kola was incorporated into proprietory broiler finisher mashes at graded levels with 0g bitter kola /kg of feed which served as control treatment 1, while treatments 2,3, and 4 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).The data collected were subjected to Analysis of Variance (ANOVA), and the differences between treatment means where they existed were separated using Duncan's New Multiple Range Test (DNMRT).

### Housing Technique

The chicks were randomly allocated into a standard dwarf walled building measuring 30m x 7.5m with wire mesh covering the height between the tops of the wall and the roof. The roof was of the asbestos type and the building was divided into 48 pens with twelve (12) pens per experimental unit each measuring 3m x 12m to provide $0.42m^2$ of floor space per bird. Polythene was utilized in the covering of the wire gauzed sides of the building to conserve environmental temperature within the building for the first few weeks. The floor was littered with wood shavings.

### Performance Parameters Evaluated

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 and feed conversion ratio. 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

**Collection of Blood Samples**

On termination of the study, twelve birds(12) i.e. 3 birds per treatment were collected for haematological assay to determine Haemoglobin (Hb), Packed Cell Volume (PCV), Red Blood Cells (RBC), White Blood Cells (WBC) and WBC differentials such as neutrophil, lymphocytes, eosinophils, monocytes and basophils. Blood samples were collected from the birds via the jugular vein into a set of well labelled sterilized bottles, containing Ethylene Diamine Tetra-Acetate (EDTA) as anti-coagulant and taken to Haematological Department of University of Port Harcourt Teaching Hospital for analyses.

**RESULTS**

The data on the effect of bitter kola (*Garcinia kola,* Heckel) as a growth promoter on broiler chickens are presented in **Table 4.1**. 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.

**Final Weight**

The mean final body weights for the birds were 2.65kg, 2.80kg, 2.85kg and 3.00kg respectively for $T_1$, $T_2$, $T_3$ 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 $T_3$.

**Body Weight Gain**

The mean total body weight gain for the birds were 2.57kg, 2.72kg, 2.77 kg and 2.91kg respectively for $T_1$, $T_2$, $T_3$ 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 $T_2$, $T_3$.

**Feed Intake**

The result 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 $T_1$, $T_2$, $T_3$ 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 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.

**Feed Cost of Production**

Data on the cost of feed showed that $T_1$, $T_2$, $T_3$, $T_4$ recorded ₦1248.00, ₦1235.25, ₦1305.70 and ₦1209.75 respectively. The data 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.

**Table 4.1. The effect of bitter kola *(Garcinia kola,* Heckel*)* on the performance characteristics of broiler chickens**

| Parameters | Treatments $T_1$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 | |

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

**Effect of Bitter Kola *(Garcinia kola,* Heckel*)* on Organ Weights**

The effect of Bitter kola *(Garcinia kola,* Heckel*)* on the organ and dressed weights are depicted in **Table 4.2**. The organs evaluated were liver, heart, spleen, gizzard, and gall bladder. All the organs and dressed weights evaluated in this study excepting that of the gall bladder were significantly (P<0.05) different at the various levels of dietary inclusion. The mean dressed weight was highest in $T_4$ (15g/kg) and least in $T_1$ (control). The dressed weights ranged from 2.05kg - 2.25kg in the control and the treated group of birds. The highest mean gizzard, heart, liver, spleen weights were recorded in $T_4$ and this was also reflected in the mean total weight gain and the dressed weight of birds.

**Table 4.2: The effects of Bitter kola *(Garcinia kola,* Heckel*)* on the dressed and organ weights of broiler chickens**

| | Treatments | | | | |
|---|---|---|---|---|---|
| **Parameters** | $T_1$(control) | $T_2$(5g/kg) | $T_3$(10g/kg) | $T_4$(15g/kg) | SEM |
| Dressed weight (kg) | $2.05^{c}$ | $2.15^{b}$ | $2.15^{b}$ | $2.25^{a}$ | 0.08 |
| Liver (g) | $28.50^{b}$ | $25.00^{b}$ | $49.50^{ab}$ | $63.50^{a}$ | 6.48 |
| Heart (g) | $8.50^{b}$ | $9.00^{b}$ | $13.00^{a}$ | $13.50^{a}$ | 1.15 |
| Spleen (g) | $1.00^{b}$ | $1.00^{b}$ | $2.50^{a}$ | $2.50^{a}$ | 0.31 |
| Gizzard (g) | $28.00^{b}$ | $28.50^{b}$ | $42.50^{a}$ | $49.00^{a}$ | 4.34 |
| Gall bladder (g) | 0.50 | 1.00 | 1.00 | 1.50 | 0.42 |

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

**Table 4.3: The effect of bitter kola *(Garcinia kola,* Heckel*)* on organ weights of broiler chicken expressed as percentage (%) of dressed weights.**

| | Treatments | | | | |
|---|---|---|---|---|---|
| **Parameters** | $T_1$(control) | $T_2$(5g/kg) | $T_3$(10g/kg) | $T_4$(15g/kg) | SEM |
| Dressed weight (kg) | $2.05^{c}$ | $2.15^{b}$ | $2.15^{b}$ | $2.25^{a}$ | 0.08 |
| Liver | 1.37 | 1.16 | 2.30 | 2.82 | |
| Heart | 0.41 | 0.42 | 0.60 | 0.60 | |
| Spleen | 0.05 | 0.05 | 0.12 | 0.11 | |
| Gizzard | 1.37 | 1.33 | 1.98 | 2.18 | |
| Gall bladder | 0.02 | 0.05 | 0.05 | 0.07 | |

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

**Effects of Bitter Kola *(Garcinia kola,* Heckel*)* on the Haematological Parameters**

Results on the heamatological parameters (Heamoglobin, Red Blood Cell, Packed Cell Volume, White Blood Cell and White Blood Cell differentials) of broiler chickens treated with varying levels of bitter kola (*G. kola*) feed additive are presented in **Table 4.3**. The result showed that apart from Red Blood Cell (RBC), all other parameters measured showed significant (P<0.05) differences.

The mean values for Heamoglobin (Hb) were 10.25g/l for $T_1$ (control). The values recorded for $T_2$, $T_3$ and $T_4$ were 10.30g/l, 10.50g/l, and 11.40g/l respectively.
Also the mean value for Red Blood Cell (RBC) were 2.40 X $10^{12}$/l for $T_1$ (control) and ranged from 2.38 X $10^{12}$/l – 2.50 X $10^{12}$/l for the treatment groups. Although there was no significant (P<0.05) differences among the control and the treated groups RBC, $T_3$ presented the highest numerical value with the least from $T_2$.

Mean values for Packed Cell Volume (PCV) were 42.00%, 42.10%, 48.20% and 50.00% respectively for $T_1$, $T_2$, $T_3$ and $T_4$.

The results obtained further showed that the values obtained for White Blood Cell (WBC) ranged from 8.30 X $10^9$/l – 13.40 X $10^9$/l for the control and the treated group of birds.

The $T_1$ (control) recorded the least value of 8.30 X $10^9$/l while $T_4$ (15g/kg) had the highest value of 13.40 X $10^9$/l.

**Table 4.4: The effect of graded levels of bitter kola (*Garcinia kola,* Heckel) on the haematological indices of broiler chickens**

| Parameters | Treatments | | | | |
|---|---|---|---|---|---|
| | $T_1$(control) | $T_2$(5g/kg) | $T_3$(10g/kg) | $T_4$ (15g/kg) | SEM |
| Haemoglobin (g/l) | 10. 25 [b] | 10.30[b] | 10.50[ab] | 11.40 [a] | 0.20 |
| Red Blood cell (x $10^{12}$/l) | 2.40 | 2.38 | 2.50 | 2.45 | 0.01 |
| Packed cell volume (%) | 42.00 [b] | 42.10 [b] | 48.20 [a] | 50.00[a] | 1.30 |
| White blood cell (x $10^9$/l) | 8.30[c] | 9.00 [c] | 10.50[b] | 13.40 [a] | 0.74 |
| WBC Differentials (%) | | | | | |
| Neutrophils | 48.60[b] | 49.00 [b] | 56.00 [a] | 59.50[a] | 1.69 |
| lymphocytes | 32.50[b] | 38.00[a] | 39.00 [a] | 32.00[b] | 1.20 |
| Eosinophils | 1.75[c] | 2.50[b] | 4.00 [a] | 3.40[a] | 0.30 |
| Monocytes | 1.50[a] | 0.80[b] | 1.50[a] | 0.85[b] | 0.09 |
| Basophils | - | - | - | - | - |

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

## DISCUSSION

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; Edacha *et al.,* 2009) and so presently, commercial additives of plant origin have been proposed and are being developed as possible replacements for synthetic antibiotics (Williams and Losa 2001, Kocabagli *et al* 2002, Lee *et al*, 2003; Aregheore *et al.,* 1998). Of these, significant attention has been placed on herbs, spices and their by-products as either single compounds or mixtures (Gill, 1999, Alaje *et al.,* 2014, Aletor *et al.,* 2002, Cabuk *et. al*., 2006) which are having phytobiotics advantages on growth response and prevents microbial, fungal, bacterial, viral multiplication and reduces its damage effect on the intestinal wall (Hossain, 2009). 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. Adedeji *et al*., (2008) also obtained better (P<0.05) hen day production and albumen weight from hens fed 10g/Kg diet dried bitter kola than those on the control treatment and those on treatments with bitter kola supplementation below and above 10g/Kg diet. Also research using Citrulluscolocynthis (bitter apple or bitter cucumber) seed meal which is also a phytogenic on broilers revealed higher (P<0.05) body weight in birds fed the seed meal than those on the control diet. Feed conversion ratio was also better (P<0.05) in broilers fed the seed meal than those on the control diet (Keniufca *et al.,* 1997; Gaytan *et al.,* 2002; Sayda *et al*., 2012).

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. Osifo *et al*., (2011) administered oral suspension of dried bitter kola to rabbits at 1200, 1500 and 1800mg/kg body weight and observed significantly (P<0.05) lower body weights from rabbits administered 1500 and 1800mg/Kg body weight oral suspension of dried bitter kola. There were no differences in terms of body weights between rabbits on the control diet and those administered 1200mg/Kg body weight. 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; Oko and Agiang 2009) 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.

Haematological parameters are important indicators of health status in animals and have been an indispensable tool in the diagnosis, treatment and prognosis of many diseases. Blood assay is a sensitive indicator that reveals the birds' general health as general changes in the parameters can be seen when no other abnormality is detected.

Normal haematological values for domestic fowl are as follows: PCV 25 – 55%, RBC 2- 4 X $10^{12}/_{l}$, Hb 7 – 13g/l, WBC 9 – 31 X $10^{9}/_{l}$ (Mitruka, H.M. and Rawnsley, S.K. 1997; Durunna *et al.*, 2009).

The function of Haemoglobin is in the transportation of oxygen and carbon dioxide. A decrease in the level of haemoglobin in the blood is indicative of poor nutrition including dietary deficiency of copper, iron, amino acids and vitamin (Frandson, 1981; Onayade *et al.,* 1998; Loycova *et al.*, 2001).

It has been established that certain haematological factors can be associated with certain production traits. For example it has been reported that high PCV and high Hb are associated with high feed conversion ratio (Jadgish and Pandey, 1994; Mitruka and Rawnsley, 1977) while high percentage of White Blood Cells especially lymphocytes are associated with the ability of the chicken to perform well under stressful conditions.

The findings in this study is in consonance with this and this is probably the reason for the relatively high performance of the birds placed on the treated groups in relation to weight gain and feed conversion with low feed intake when compared with the control group. The PCV values obtained in this study agreed with the reports of (Hunt *et al.*, 1980; Mitruka and Rawnsley, 1977; Banerjee, 2008; Owen and Amakiri, 2012). This could be due to compensatory accelerated production of Packed Cell Volume which returns PCV levels to normal level (Tambuwal *et al*, 2002; Owen and Amakiri 2011).

The WBC plays a major role in defending the body against disease producing bacteria, viruses and fungi. A deficiency in WBC may result in an increased susceptibility to infections. The higher values of WBC recorded in the treated groups is suggestive of a well adapted immune system. A decrease in white blood cell count in birds placed in the control group is a reflection of the decline in the production of WBC for defensive action against infections. It probably explains why the birds in the treated groups consumed less feed and presented better weight gain and feed conversion when compared to the control which may have been subjected to various physiological stresses. However, all the haematological parameters evaluated had values that fall within the normal range and mean values of chickens as reported by Mitruka and Rawnsley (1997) and Banerjee (2008).
Consequently, the effects of any feed ingredient or additive on the blood profile of the chicken are of immense assistance in deciding whether or not such a feed ingredient or additive should be used in poultry feed (Owen *et al.,* 2008; Terashima *et al.,* 2002).

## REFERENCES


Adedeji, O. S., Farinu, G. O., Ameen, S. A., &Olayeni, T. B. (2006). The effects of dietary bitter kola (Garciniakola ) Inclusion on body weight, haematology and survival rate of pullets chicks. *J. Anim. Vet. Adv., 5*(3), 184-187.

Adedeji, O. S., Farinu, G.O., Olayeni, T. B., Ameen, S. A., &Babatunde , G. M (2008). Perfomance and Egg Quality Parameters of Laying Hens Fed Different Dietary Inclusion Levels of Bitter Kola (*Garcinia kola*) *Research Journal of Poultry Sciences, 2,* 75-77.

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.

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.

Adumoradi, M; Navidshad, B; Saif, D.J &Royan, M. (2006).Effect of dietary garlic meal on histological structure of small intestine in broiler chickens.*J. Poult. Sci*, 43:378-83, 2006.

Afolabi F. Eleyinmi, David C. Bressler, Isiaka A. Amoo, Peter Sporns, Aladesanmi A. Oshodi, (2006), Proximate, phytochemical, elemental composition (g/kg, dwb) and energy content of Garcinia kola seeds and hulls. *Polish journal of food and nutrition sciences,* Vol. 15/56, No4, pp. 395-400

Akpan, M.J.; Enyenihi, G.E.; Obasi, O.L.; Solomon, I.P. and Udedibie, A.B.I. (2008). Effects of dietary neem leaf extract on the performance of laying liens. *Proc. 33rd Ann. Conf. Nig. Soc. Anim. Prod*. March 20th – 25th pp. 396 – 398.

Akpantah, A.O., A.A. Oremosu, C.C. Noronha, T.B. Ekanem and A.O. Okanlawon. 2005. Effects of *Garcinia kola* seed extract on ovulation, oestrus cycle and foetal development in cyclic female spraquedawley rats. *Nig. J. phys. Sci*. 20(1-2):58–62.

Alaje, D. O.; Owolabi, K. T.; Olakunle, T. P.; Oluoti, O. J.; Adetuberu, I. A. (Feb 2014). Nutritional, minerals and phytochemicals composition of Bitter kola *(Garcinia kola).Journal of environmental science, toxicology and food technology* Vol. 8, pp 86-91.www. iosrjournals. Org

Aletor, O.; Oguntokun, M.O. and Aletor, V.A. (2002).Proximate composition, energy content and mineral profile of some conventional and under-utilized fibrous feed resources.*Proc. 27th Ann. Conf., Nig. Soc. for Anim Prod. (NSAP)*, March 17 – 21st, Fed. Uni. of Tech. Akure, Nig. pp. 135 – 138.

Aluka, (1985). In: Entry for Garcinia kola Heckel (Guttiferae), The useful plants of West Tropical Africa. Burkill, H. M. VOL. 2

Aregheore, E.M.; Makkar, H.P.S and Becker, K (1998). Feed value of some browse plants from the central zone of the Delta State, *Nigeria Tropical Science* 38 (2): 97 – 104.

Banerjee, G. C. (2008). Textbook of animal husbandry.Bidhan Chandra Krishi Viswaridyalaya. Oxford and IBH publishing Co. PVT Ltd.

Braide, V.B. 1993. Anti-inflammatory effect of kolaviron, a biflavonoid extract of *Garcinia kola*. *Fitoterapea., LXIV*: 433 -516.

Cabuk, M.; M., Bozkurt, A. Alcilek; Y. Akbas and K. Kucikyilmaz (2006). Effect of a herbal essential oil mixture on growth and internal organ weight of broilers from young and old breeder flocks. *S. Afri. J. Anim. Sci.,* 36:135-141

Cross, D. E; McDevitt, R. M; Hillman, K., and Acamovic, T. (2007).The effect of herbs and their associated essential oils on performance, dietary digestibility and gut microflora in chickens from 7 to 28 days of age.*Br. Poult. Sci. 48*: 496-506.

Dada, A. A., & Ikuerowo, M. (2009). Effects of ethanolic extracts of *Garcinia kola* seeds on growth and haematology of catfish (*Clariasgariepinus*) broodstock. *African Journal of Agricultural Research*, *4*(4), 344-347.

Durunna, C. S.; Chiaka, I.I.; Udedibie, A.B.I.; Ezeokeke, C.T. and Obikonu, H.O.( 2009). Value of bitter leaf (Venoniaamygdalina) leaf meal as feed ingredient in the diet of finisher broiler chicken.*Proc. of the Int. Conf. on Global Food Crisis*, April 19th – 24th, Fut, Owerri – Nigeria, pp. 38 – 42.

Edache, J.A.; Musa, U.; Karsin, P.D.; Yisa, A and Okpala, E.J. (2009). Effects of graded levels of neem (*Azadirachtaindica*) leaf meal on the performance of growing rabbits. *Proc. 34th Ann. Conf. Nig. Soc. for Anim. Prod*. March 15th – 18thUyo – Nigeria. pp 359 – 361.

Frandson, R.D (1981). *Anatomy and physiology of farm animals.*Lea Febinger publishers, Philadelphia, 1st ed. pp86-94.

Gaytan, E., E. Trradas, C. morales, C. Bellido and J. Sanchez-Criado. 2002. Morphological evidence for uncontrolled proteolyses activity during the ovulatory process in indomethacin-treated rats. *Reprod*. 123:639-649.

Gill, C. (1999). Herbs and plant extracts as growth enhancers. *Feed Int., 20*(4): 20-23.

Hemandez, F., J. Madrid; V. Gracia; J. Orengo and M. D. Megias (2004). Influence of two plant extracts on broiler performance, digestibility and digestive organ size. Poult. Sci., 83:169-174.

Hunt, S.; Goff, L.V. and Holbrook, J. (1980). Nutrition principles and chemical practices. John Willey and Sons. New York pp 49 – 52.

Ibekwe, H .A. and Orok, E .E. (2010). Proximate Composition of *AframomumMelegueta*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.

Jadgish, P and Pandey, R.C. (1994).Effect of different level of garlic induction in the ration of cockerels in their growth rate and feed conversion rario.*Poult. Adv.* 27:39-41.

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.

Kenjufca, V.H; Pesti, G.M. and Bakalli, R.I. (1997).modulation of cholesterol level in broiler meat by dietary garlic and copper. Poult.Sci 76:1264-71.

Kocabagli, N. M. Alp; N. Acar and R. Kahraman (2002).The effect of dietary humate supplementation on broiler growth and carcass yield.Poult. Sci. 81:227-230

Lee, K.W.; Everts, H.; Kappert, H.J.; Frehner, M.; Losa, R., Beynen, A. C. (2003).Effects of dietary essential oil components on growth performance, digestive enzymes and lipid metabolism in female broiler chickens.*Br. Poult. Sci, 44:* 450-457.

Lim, H., B. Paria, S. Das, J. Dinchuk, R. Langenbach, J. Trzaskos, and S. Dey. 1997. Multiple female reproductive failures in cyclo-oxygenase -2 deficient mice. *Cell*. 17:197-208.

Lovkova, M. Y.; Buzuk, G. N.; Sokolova, S .M., Kliment'eva, I. (2001). Chemical features of medicinal plants (Review). *ApplBiochem. Microbiol.*37, 229-237

Mitruka, H.M. and Rawnsley, S.K. (1997*). Clinical, Biochemical and hematology reference in moral experimental animal.*Mason, N.Y. pp. 287-380.

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 (*Afromomummelegueta*). *African Journal of Biotechnology*, *8*(2), 308-310.

Oko, O.O.K. and Agiang, E.A. (2009). Phytochemical evaluation of 3 extractants of Aspilia African leaves. *Proc. of the Intern.Conf.on Global Food Crisis*, April 19th – 24th, FUT, Owerri – Nigeria.pp 87 – 90.

Okunji, C .O.; and Iwu, M. M. (1991). Molluscidal activity of *Garcinia Kola* biflavononesJournal of Environment and Ecology ISSN 2157-6092 2013, Vol. 4, No. 2 www.macrothink.org/jee 104

Okunji,C .O.; Tantalia, A.W.; Hicks, R. P.; Iwu, M .M., and Skanchy, D. J. (2002). Capillary electrophoresis determination of biflavononesfrom *Garcinia kola* in three traditional African medicinal formulations.*Plant Med*., *68,* 440-444.

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

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.

Onayade, O A.; Looman, A. M. G., Scheffer, J .J .C., and Gbile, Z .O. (1998). Lavender lactone and other volatile constituents of the oleoresin from seeds of *Garcinia*

*Kola* Hechel.*Flavour and Fragrance., 13* (6), 409-412. http://dx.doi.org/10.1002/(SICI)1099-1026(199811/12)

Osifo, U .C.;Akpamu,U., Otamere, H. O., and Ekhator, C. N. (2011). A murine model study on the effect of Garcinia kola on body weight.*Archives of Applied Science Research,* 2011, *3*(5), 526-531. Retrieved from http://scholarsresearchlibrary.com/archive

Owen, O.J.; J.P. Alawa; Wekhe, S.N.; Aniebo, A.O.; Ngodigha, E.M and Amakiri, A.O. (2008). Hematological and biochemical responses of weaner rabbits fed diets containing graded of poultry litter, *Biotech and Biochem*. Vol. 4 No. 1: 33 – 37.

Owen O.J. and A.D. Amakiri (2011).serological and hematological profile of broiler finishers fed graded levels of bitter leaf (V. amygdaline) meal. *Advances in Agricultural Biotechnology*, 1: 77-81

Owen, O. J. and Amakiri, A. O. (2012). Evaluation of ginger (*Zingiberofficinale*) as feed additive on the performance characteristics and haematological profile of broiler birds. *Proc. 17th Annual Conf. Animal Science Association Of Nigeria (ASAN),* Abuja, 9th – 13th September pp. 434 – 437.

Plowden, C. C. (1992). A manual of plants names 3rd edition., London geroge Ltd. pp239.

Sayda, A .M.; Ali, H., Abdalla, O., and Mohammed, A .E. (2012). Citrullus Colocynthis (Handal) Seed Meal As A Natural Feed Supplementation In Broiler Chickens' Diets. *Egypt. Poult. Sci.* (32) (II), (237-246).

SPSS (2005).Statistical Package for the Social Sciences version 17.

Tambuwal, F. M., B. M., Agala and M. Bangana (2002).Haematological and biochemical values of apparently healthy red Sokoto goats. Proc. 27TH Ann. Conf. Nig. *Journal Anim. Prod. March 17th – 21st,* pp. 50-53.

Terashima, K., Y. Takaya and M. Niwa. 2002. Powerful antioxidative agent based on garcinoic acid from *Garcinia kola*. *Bio. Org. Med. Chem*. 10(5):1619–1625.

Terashima, K.; Kondo, Y., Aqil, M. and Waziri, M (1999).A study of biflavanones from the stem of *Garcinia kola*.*Heterocycles, 50*(1), 283-290. DOI: 10.3987/COM-98-S(H)40.

Tipu, M.A.; Pasha, T.N. and Ali, Z. (2002).Comparative efficiency of salinomycin sodium and neem (*A. indica*) as additive anticoccicidal in broilers.*Int. J. Poult*. Sci. 1: 94 – 94.

Tollba, A.A.H and Hassan, M.S.H. (2003). Using some natural additives to improve physiological and productive performance of broiler chicks under high temperature conditions 2-black cunin (Nigella sativa) or garlic (Allium satvium) *Egypt Poult sci* 28:327-40.

Uko, O.J., A. Usman, and A.M. Ataja. 2001. Some biological activities of *Garcinia kola* in growing rats. *Vet. Arhiv*. 71:287–297.

Wenk, C. (2000). Why all the discussion about herbs? Proc. Alltech's 16th Ann. Symp.Biotechnol.in the Feed Industry. Ed. Lyons, T.P., Alltech Tech. Publ., Nottingham, University Press, Nicholasville, KY. pp. 79-96.

WHO (2002). World Health Organization: Use of antimicrobials outside human medicine and resultant antimicrobial resistance in humans. https://apps.who.int/inf-fs/en/fact268.html

Williams, P., and Losa, R (2001).The use of essential oils and their compounds in poultry nutrition. *World's Poult 17*, 14-5

Windisch, W.; Schedle, K.; Plitzner, C., Kroismayr, A. (2008).Use of phytogenic products as feed additives for swine and poultry. *J. Anim Sci., 86*, 140-148.

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