Growth performance, organ weight and histology of rabbits fed graded levels of bitter kola (*Gracinia kola*)

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Abstract

The effect of varying levels (0%, 2.5%, 5% and 7.5%) of *Garcinia kola* on the carcass, organ weight and growth performance of growing rabbits were investigated using twenty four rabbits of mixed breed (New Zealand white and Chinchilla) and mixed sexes of average weight 1 ± 0.49 kg. The rabbits were randomly assigned to four dietary treatments comprising *Garcinia kola*: T_1 (0%), T_2 (2.5%), T_3 (5%) and T_4 (7.5%) for 56 day period of the experiment. The experiment was based on Completely Randomized Design with each treatment having six rabbits in three replicates of two rabbits per replicate. During the 56 days period of the experiment, the rabbits were subjected to similar managerial and sanitation conditions such that the only source of variation is the level of *Garcinia kola* inclusion. At the end of the 56 days treatments, three rabbits were randomly selected from each treatment, weighed, slaughtered, skinned and eviscerated. The carcass weight and organ weight were also taken. Thereafter, the internal organs precisely the liver and kidney were prepared for histological analysis and taken to Nnamdi Azikiwe University, Awka Teaching hospital histological section for analysis. Results showed no significant differences ($P > 0.05$) in most of the parameters measured except for the carcass weight and kidney weight but the differences did not take any particular trend that could be attributed to the effect of the bitter kola (*G. kola*). There was also no significant difference ($P < 0.05$) for feed intake level, feed conversion ratio and specific growth rate. Weight gain however differed significantly ($P < 0.05$) with treatments ($T_4 < T_3 < T_2 < T_1$) meaning that body weight gain decreased as the level of bitter kola inclusion increased. The kidneys of rabbits fed bitter kola all had different degrees of damage. Similarly, the histology of the liver organs of rabbits fed different levels of bitter kola showed that rabbits on T_1 (0%) bitter kola was normal, while the liver of those that had the test ingredient bitter kola all had defects. We therefore recommend large doses of *G. kola* should be given to rabbits else the negative effects will outweigh the gains of its phyto-biotic properties.

Keywords: *Garcinia kola*, Histological analysis, Internal organs, Phyto-biotic properties

Introduction

Continuous quest to bridge the gap between population explosion and food shortages, has made it imperative to search for alternative means of survival. In order to ensure adequate supply of protein to the rapidly growing population of Nigeria the output of animal products has to be increased (Ogbu and Herbert 2016),

especially with short cycle animals like rabbits, pigs and poultry (Ozor and Madukwe, 2000). Animal protein is very essential for the growth, development and maintenance of human life as it contains all the essential amino acids needed for this purpose. Unfortunately, poultry and pigs require food sources that are in direct competition with man, unlike rabbits that

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can be raised from forages and feed materials that freely abound in the tropics (Biokuku, 1993). Rabbits have high growth rate, very high prolificacy and fecundity levels, quicker return on investment, short gestation period with high quality and nutritious meat, and as well as simple management techniques (Hassan *et al.*, 2012).

Many materials have been used to improve the productivity and health of growing rabbits. Kuldeep *et al.* (2014) reported that feed additives have attracted increasing interest as an alternate feeding strategy to replace antibiotic, prevent diseases and at the same time minimize production cost. According to Windisch *et al.*, (2008), this has been banned completely from use as additive in livestock feeds since 2006, because of a suspected risk of generating microbiota with increase resistance to the antibiotic used for therapy in humans and animals. Bitter kola is one of such phyto-genic feed additives with medicinal properties. Bitter kola (*Garcinia kola*) is a popular fruit in West Africa. It is highly sought after for its powerful antibiotic, anti-poison and antimicrobial properties (Adeboye *et al.*, 2008). Iwu *et al.* (1990) reported a complex mixture of phenolic compounds including bioflavonoids, xanthnes and benzophenones in *Gracinia kola*. The bioflavonoids, according to Adedji *et al.*, (2006) possess anti-inflammatory, anti-microbial, anti-viral and anti-diabetic properties. Ekene and Ertirbie (2014) reported that *G. kola* prolongs life, because of the chemical compound found in it that assists in the breaking down of glycogen present in the liver, which results in longevity. *G. kola* has also been used as an additive to assess the performance of broiler chickens (Mohammed and AbdulMalik, 2014). While the medicinal values of *G.kola* have

captured research interest, some of its anti-nutritional properties are yet to be assessed. Hence, its possible effects on the rabbit's internal organ weights, histology and general growth performance were assessed in this study.

Materials and methods

Study area

The study was carried out at Nnamdi Azikiwe University, Faculty of Agriculture, Teaching and Research Animal House, Rabbitry Unit at Awka. Awka lies within the co-ordinates 6°12'-N and 7°04'-E. It has an annual rainfall of about 1828mm with an average climatic temperature range of 29°C and 34°C.

Experimental animals and management

Twenty four rabbits of mixed sexes and breed of New Zealand white and Chinchilla rabbits were used. The rabbits used for the experiment were three (3) months old with an average weight of 1 ± 0.49 kg procured from University of Nigeria, Nsukka Teaching and Research Farm, while the bitter kola was bought from Afor Nnobi in Idemili South Local Government Area of Anambra State. The rabbits were allowed to acclimatize with the new environment for about two weeks before the commencement of the experiment, during this period, they were de-wormed and vaccinated. Feed and water were given to the rabbits' *ad-libitum*. The rabbits were housed in colony cages measuring 120cm x 80cm x 45cm for the 56 days period of the experiment. The bitter kola was oven dried at a low heat of 300°C for 48 hours. Chopped to pieces, ground and was added to each treatment at varying levels in accordance with the design of the experiment. Treatment 1 (T₁) had 0% bitter kola and served as control. Treatment 2 (T₂) had 2.5% bitter kola, while Treatment 3 (T₃) and Treatment 4 (T₄) contained 5% and 7.5% bitter kola respectively. The design of

the experiment was completely randomized design with each treatment having six (rabbits) in three replicates of two rabbits per replicate.

Data collection

At the end of the 56 days feeding trial, three rabbits were randomly selected from each treatment, weighed, slaughtered, skinned and eviscerated. The carcass and internal organ weights were recorded with the aid of Sensitive Sartorius Electronic Scale.

Growth parameters were assessed include weight gain (calculated by deducting initial weight from final weight of the rabbits with the aid of Nana power kitchen scale), Feed conversion ratio (calculated as weight of food consumed divided by weight gain of the rabbits.. Specific growth rate (SGR) was calculated using the formula

$$SGR = \frac{\log_e W_2 - \log_e W_1}{T_2 - T_1} \times \frac{100}{1}$$

Where; $\log_e$ is natural logarithm, W_2 is final weight, W_1 is initial weight and T_2 final time, T_1 initial time.

The histological studies on the liver and kidney were carried out at Nnamdi Azikiwe Teaching Hospital Histology Section

Nnewi. Excised organs were fixed in 10% of formalin, cut sections of different tissues were collected to represent each organ placed in tissue cassette and dehydrated in ascending grades of alcohol (70%, 90%, 95%) for 2hours each. Four changes of absolute alcohol for 1hour to ensure absolute proper dehydration and dealcoholized in three changes of xylene for 15minutes each. The tissues were impregnated into two changes of molten paraffin wax for 10minutes each and were embedded using embedding system harboring the molten wax at 58^oc and cooled immediately in ice cool chamber until hardened. Trimmed sections were using rotary microtome at 5 μ and thereafter stained using H and E method (Hematoxylin and Eosin method), drying and mounting was done using DPX (Dibutyl phthalate polyesterone xylene). Slides were viewed at x10 and 40 objective.

Statistical analysis

The data were subjected to Analysis of Variance (ANOVA) at 5% probability level (P0.05). The means were compared using Duncan's New Multiple Range Test according to Obi (2002).

Table 1: Gross composition of the experiment diet

Ingredients	T ₁ (0%)	T ₂ (2.5%)	T ₃ (5%)	T ₄ (7.5%)
Maize	40.00	39.00	38.00	38.00
Bitter kola seed meal	0.00	2.50	5.00	7.50
Soya bean Cake	7.00	6.00	5.00	4.00
Fish meal	1.00	1.00	1.00	1.00
Blood meal	1.00	1.00	1.00	1.00
Wheat meal	46.00	46.50	46.00	44.50
Bone Meal	3.00	3.00	3.00	3.00
Salt	0.25	0.25	0.25	0.25
Vitamin Premix	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25
Total	100	100	100	100

Calculated Crude Protein =16%

ME/kcal/kg =2400

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Results and discussion

The mean values of the carcass and internal organ weight of the rabbits were shown in Table 2. There were no significant differences ($P > 0.05$) for most of the parameters measured except for the carcass and kidney weight. The result corroborates the findings of Esiegwu *et al.* (2013) who reported that there were no treatment effects on the weight of the liver, lungs and hearts of rabbits fed with *Garcinia kola* Seed Meal. In this study, though there were significant ($P < 0.05$) differences on the carcass and kidney weight, it did not take any particular trend that could be attributed to the effect of the bitter kola.

The mean values of the indices of growth performance of rabbits fed graded levels of bitter kola are presented in Table 3. There were no significant difference ($P < 0.05$) for feed intake level, feed conversion ratio and specific growth rate. Weight gain differed significantly ($P > 0.05$) with treatment one (T₁) gaining the highest weight. Body weight gain decreased as the level of bitter kola inclusion increased. This finding was in line with Uko *et al.*, (2001) earlier report that bitter kola decreased the body mass of rats. This suggests that bitter kola may have weight control potentials. There was a numerical decrease in feed in take as the level of bitter kola inclusion increased. This report corroborates earlier report of Uko *et*

al. (2001) and Nottidge *et al.* (2008). Reduction in feed in take may be attributed to bitter taste of bitter kola.

Picture 1, shows slides of histology of the kidneys of rabbits fed bitter kola at different levels. The kidneys of rabbits fed bitter kola all had different degrees of damage. Plate 2 (2.5%) had foci of tubular hemorrhage. Plate 4 (5%) had mild cystic formation and intertubular hemorrhage. Plate 5 (7.5%) also had mild cystic formation and inter tubular hemorrhage. Picture 2, shows the histology of the liver organs of rabbits fed different levels of bitter kola. Plate 1 (0%) bitter kola was normal, while plate 7, 8 and 9 which had the test ingredient bitter kola all had defects. These results corroborate the findings of Braide and Grill, (1990) and Esiegwu *et al.* (2013) who reported that dried powdered *Garcinia kola* seed meal causes some histology alterations in the kidney and liver of rats and laying hens respectively.

In conclusion, using bitter kola at different levels has a stimulatory effect on fat metabolism and thus anti-obesity. It had no serious physical variations on the weighed internal organs but histological examination shows that its consumption must be done with caution to avoid delirious effects on the organs, large doses especially for a number of days should be avoided.

Table 2: Internal organs and carcass weight of rabbits fed graded levels of bitter kola

Parameters (g)	Treatment inclusion levels of <i>G. kola</i>			
	T ₁ (0%)	T ₂ (2.5%)	T ₃ (5%)	T ₄ (7.5%)
Carcass	658.88 ⁺ 46.931 ^b	581.40 ⁺ 133 ^b	966.50 ⁺ 51.760 ^a	602.90 ⁺ 60.387 ^b
Liver	26.15 ⁺ 8.415	20.95 ⁺ 4.313	28.50 ⁺ 9.192	21.00 ⁺ 1.414
Lungs	6.55 ⁺ 1.909	4.90 ⁺ 0.141	6.98 ⁺ 1.874	5.60 ⁺ 0.849
Heart	4.25 ⁺ 0.707	2.85 ⁺ 0.071	3.85 ⁺ 0.071	3.20 ⁺ 0.707
Kidney	7.85 ⁺ 0.071 ^b	6.55 ⁺ 0.778 ^c	9.65 ⁺ 0.71 ^a	7.40 ⁺ 1.41 ^{ab}

^{abc}Means with different superscripts are significantly different ($P < 0.05$)

Table 3: Effect of bitter kola at various levels of inclusion on growth performance of rabbits

Parameters (g)	T1 (0%)	T2 (2.5%)	T3 (5%)	T4 (7.5%)
Weight gain	0.12 ^a	-0.16 ^b	-0.24 ^{bc}	-0.39 ^c
Feed intake	336	328	323	309
FCR	2800	-2050	-1345	-0.075
SGR	0.032	-0.055	-792.3	-0.190

^{abc}Means with different superscripts are significantly different ($p < 0.05$)

FCR - feed conversion ratio. SGR – specific growth rate.

Plate 2: Kidney (T₁) Normal

Plate 3: Kidney (T₂) Not normal

Focus of tubular hemorrhage

Plate 4: Kidney (T₃) Not normal
Mild cystic formation and intertubular
Hemorrhage

Plate 5: Kidney (T₄) Not normal
Mild cystic formation and intertubular
Hemorrhage

Picture 1: Histology of kidney organ observed

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Plate 6: liver (T₁). Normal

plate 7: liver (T_{2.5}) Not normal
Foci area of central vein and
Hepatic hemorrhage

Plate 8: liver (T_{5.1}) Not normal,
Mild tubular destruction within
renal pelvis.

Plate 9: Liver (T_{7.5}) Not normal,
Mild tubular destruction within
the renal pelvis and moderate
hemorrhage

Picture 2: Histology of the liver organ observed

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