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Effects of Feeding Graded Levels of *Costus afer* on Growth, Organ Weight and Haematological Indices of Growing Rabbits

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Abstract: *A feeding trial was conducted on a four to five months old young rabbits for eight, to determine the effect of graded levels of* Costus afer *on growth performance, organ weight and haematology indices. Weight gain and feed intake were significant (P<0.05) with a range of 0.14 to 0.44 kg and 0.76 to 0.77kg respectively. Carcass weight was not significantly different among the four treatments. Heart, liver, kidney and testis weight varied significantly (P<0.05), but spleen and ovary weight were not. White blood cells (WBC), Red Blood Cells (RBC), Mean Cell Haemoglobin (MCH), Haemoglobin (Hb) and Packed Cell Volume (PCV) were not significantly (p>0.05) different in the rabbits across the treatment groups. The study concludes that Corstus afer leaf meal had no detrimental effect on internal growth, organs and haematological parameters of rabbits and up to 10% level of inclusion.*

Key word: Cortus afer, growth indices, organ weight, Haematological indices

I. Introduction

Animal protein intake has been on steady decline among Nigerians owing to high cost of meat and other animal products. Rabbits (*Oryctolagus cunniculus*), a prolific animal with short gestation period, has enormous potentials in alleviating the problem of animal protein supply in developing economies (Biobaku and Dosumu, 2003). Its unique attributes includes the ability to convert forage crop residues and agro-industrial by-products more efficiently into meat than most other livestock (Sese et al., 2013), small sizes, ease of management, high reproductive potential and fast growth rate (Odimba, 2006).

The ever increasing cost of conventional animal feed ingredients and low protein intake in most developing countries has necessitated animal nutritionists in recent years to search for cheaper locally available and nutritionally viable alternative feedstuffs (Onwuka, 1992; Jegede et al., 2006). Recent studies on the potentials of leaf meals in the diet of livestock (Amata and Bratte, 2008; Amata et al., 2009) have shown significant growth responses by animals fed such meals.

Such leaf meals have been shown to yield relatively higher levels of crude protein and minerals and lower crude fibre levels than tropical grasses. They are therefore gaining acceptance as feedstuff in livestock diets and are considered to be non-conventional feeding materials (Onwuka et al., 1989; Esonu et al., 2003; Okagbare et al., 2004; Amata, 2010). The nutrient profile of some of these non-conventional feeding materials compare favourably well with some conventional feeding materials (Aderinola et al., 2008; Amata, 2010; Amata and Lebari, 2011). Therefore Leaf meal supplementations are now being included in the feeding regiment of animals as means of reducing production cost and maximizing profit.

Costus afer, is a stout, perennial and rhizomatous herbs of the genus *Costus*. It is found in the forest belt of Senegal, South Africa, Guinea, Niger, Sierra Leone and Nigeria (Buckle, 1995; Edeoga and Okoli 2000). *C. afer*, is commonly called bush sugar cane or monkey sugar cane (Nyananyo, 2006). In Nigeria, It is called ireke-omode (Yoruba), *okpet* , *okpoto,* or *ohia* (Igbo), *kakizuwa* (Hausa) and *mbritem* (Efik) (Samuel and Chukwunonso, 2009). It is non-branched tropical plant with creeping rhizome commonly found in moist or shady forests of West Africa. It bears white and yellow flowers. The stem, seeds and Rhizomes harvested from the wild contain several bioactive metabolites (Stentoft, 1988). It is a useful medicinal plant that is highly valued for its anti-diabetic, anti-inflammatory and anti-arthritic properties in South-East and South-West Nigeria (Soladoye and Oyesika, 2008; Okoko, 2009). These properties had probably informed its inclusion in forages provided to animals by livestock farmers, especially in the rural areas. It is against this background therefore that this study was conducted, to evaluate the effects of feeding graded levels of *C. afer* on growth, organ weight and haematological indices of rabbits.

II. Materials and method

The study was carried out at the Rabbitry unit of the Niger Delta University Teaching and Research farm. Thirty-two, four to five (4-5) months' old rabbits of were purchased from the University of Port Harcourt Teaching and Research farm and used for this study.

The animals after purchase were given a one week preconditioning of the same management. During this period, feed and water were given ad libitum. Feeders and drinkers were properly washed and disinfected in order to ensure proper hygiene.

The thirty-two rabbits were housed in a single-tier wire-meshed huge, constructed with wooden frame and was divided into three compartments. The rabbits carefully tagged and housed in each allocated replicate based on the experimental design and treatment.

C. afer leaves were harvested from the vegetations around the experimental site. The plant was cut from the base avoiding the roots and was chopped into smaller bits. After which they were sun dried for three to four (3-4) days retaining their greenish coloration. The dried-chopped plant was then milled and stored in a protective sac to avoid contamination.

The thirty-two rabbits were randomly allocated into four treatment groups in a completely randomized design (CRD). Each treatment was replicated twice with four animals per replicate. Treatment one (T1) served as the control with animals that were fed with growers mash and forages with no *C. afer*, Treatment two (T2) were fed growers mash and 5% inclusion of *C. afer* and forages, Treatment three (T3) were fed growers mash and 10% inclusion of *C. afer* and forages, and Treatment four (T4) were fed with growers mash and 15% inclusion of *C. afer* and forages.

Four hundred grams (400g) of the graded levels of feed was given to the animals in each replicate in a treatment. The left over feed were weighed and subtracted from the given feed in each replicate to determine the feed in-take in a treatment. The feed was also supplemented with green forages such as Ipomoea spp, Aspillic africana, etc. The experiment lasted for a period of eight (8) weeks after a one (1) week of preconditioning, after which the required data were collected.

The proximate compositions of the plant samples were determined by adopting the official method of analysis by A.O.A.C, (2002). The crude proteins were obtained according to the A.O.A.C (2002) protocol, while crude fibre was extracted for three hours using a soxhlet apparatus. Soluble carbohydrate was obtained by the difference method. Ash was determined by incineration of the samples in a muffle furnace at 600^0C for 3 hours.

The initial body weight of all the rabbits were taken and recorded at the commencement of the experiment. The thirty-two rabbits in there different treatments were also weighed on weekly basis during the period of the experiment so as to determine their weekly weight gained.

The feed in-take was evaluated by taking the measured quantity of feed given to each replicate in a treatment, which was four hundred grams (400g) on daily basis, and then subtracting the remnant feeds to determine the difference which was recorded as the feed in-take in each replicate in a treatment.

At the end of the experimental period, two rabbits per replicate in a treatment were randomly selected and slaughtered by cutting the jugular vein to allow proper exsanguinations. Blood for haematological analysis was expelled gradually into tubes containing EDTA and delivered to the laboratory within 2 hours of collection for prompt assay. Haematological parameters assayed include; haemoglobin (Hb), White blood cell count (WBC), Red blood count (RBC), mean erythrocyte haemoglobin concentration (MCHC), packed cell volume (PCV), neutrophils and lymphocytes.

Slaughtered rabbits were eviscerated to evaluate their carcass weight which was recorded as hot carcass weight. Organs, including Liver, Heart, Spleen, Ovaries and Kidney were extracted and weighed using a sensitive scientific grade scale.

Data collected were subjected to Statistical analyses using SPSS Version 11.5 software. Arithmetic mean, standard error of means and Analysis of variance (ANOVA), Steel and Torrie, (1980) were calculated. Where differences existed, Duncan's Multiple Range test (Duncan, 1955) was used to separate the mean.

III. Results and discussion

Table 1. Experimental diets comprising graded levels of Costus afer leaf meal fed to Growing Rabbits

Ingredients (%)	Experimental Diets			
	T1	T2	T3	T4
Maize	14.50	13.00	12.2	12.00
C. afer leaf Meal	0.00	5.00	10.00	15.00
Soya bean meal	5.00	3.00	3.00	3.00
Palm Kernel cake	29.30	29.30	26.30	22.90
Fish Meal	4.00	3.00	2.00	1.00
Rice Offal	12.00	10.50	10.50	10.50
Wheat Offal	29.00	30.00	30.00	30.00
Palm Oil	4.00	4.00	4.00	3.40
Bone Meal	1.00	1.00	1.00	1.00
DL-Methionine	0.30	0.30	0.30	0.30
DL-Lysine	0.20	0.20	0.20	0.20
Salt (NaCl)	0.50	0.50	0.50	0.50
*Vitamin	0.20	0.20	0.20	0.20
mineral premix	100	100	100	100
Total (%)Nutrient Composition				
Crude protein (%, Calculated)	23.52	23.48	23.50	23.52
Crude protein (%, Analyzed)	15.00	15.13	15.42	14.90
Crude Fibre (%, Calculated)	3.51	3.97	4.50	5.03
Ether Extracts (Fat; %, Calculated)	4.22	4.17	4.12	4.07
Ether Extracts (Fat; %, nalyzed)	5.00	3.98	4.00	4.22
Lysine (%, Calculated)	1.18	1.10	1.03	0.95
Methionine (%, Calculated)	0.45	0.43	0.41	0.39

*Vitamin A 8000000 I.U, vitamin D3 1600000 I.U, vitamin E 5000 I.U, vitamin K 2000 mgr, Thiamine 1500 mgr, Riboflavin B2 4000 mgr, Pyridoxine B6 1500 mgr, Niacin 15000 mgr vitamin B12 10 mgr, Pantothenic Acid 5000 mgr, Folic Acid 500 mgr, Biotin 20 mgr, Choline chloride 200 gr, Antioxidant 125 gr, Manganese 80 gr, Zinc 50 gr, Iron 20 gr, Copper 5 gr, Iodine 1.2 gr, Selenium, 200 mgr Cobalt 200 mgr.

Table 2: Growth performance of rabbits fed with graded levels of Costus afer

Parameters/ Treatment	T1	T2	T3	T4
Initial Weight (kg)	1.28	1.23	1.36	1.38
Weight gain (kg)	0.33±0.09[a]	0.32±0.04[a]	0.44±0.04[a]	0.14±0.04[b]
Feed Intake (kg)	0.76±3.16[a]	0.77±2.33[ab]	0.77±1.85[ab]	0.77±3.56[b]
Carcass Weight (kg)	1.23±0.02	1.35±0.10	1.48±0.08	1.20±0.10
FCR	2.30	2.40	1.75	5.50

Means with different superscripts in each row are significantly different (P<0.05).

Table 2 shows growth indices measured on young rabbits fed with graded levels of *C. afer*. Weight gain was significant at P<0.05, and ranged from 0.14 to 0.44 kg with T4 recording the least weight gained. Feed intake was also significant at P<0.05, with a range of 0.76 to 0.77kg. Carcass weight was not significantly different among the four treatments. While average feed intake was uniform for all the treatments at 0.7kg, Weight gain was best for rabbits fed treatment three; suggesting that rabbits in this treatment group better growth performance than the other treatment groups. The implication of 5 to 15 percent C.afer in the diet of growing rabbits has no negative effect on feed intake, but growth is best enhanced at 10% inclusion. T3 produced a very good weight gain than all other treatments while T4 showed weight depression which has been attributed to the effect of toxic alkaloids present in feeds and have the potential to inhibit growth activities (Ujowundu et al., 2010; Anderson et al., 1995; Salvin et al., 1997). Although the feed conversion ratio (FCR) did not show significant difference (P>0.05) among the treatment groups, it also numerically favoured animals in T3 (1.75), which makes it comparatively a better diet than the rest, since lower values of feed conversion ratio indicates superiority of the diet (Ogbonna et al., 2002). FCR range of 1.75 to 5.50 observed in this study is lower than 6.96 to 7.9 reported by Sese et al. (2014) as the average feed conversion ratio for young rabbits fed Mucuna utilis.

Table 3. Organ weight of rabbits fed with graded levels of Costus afer.

Organs weight (g)	T1	T2	T3	T4
Heart	3.05±0.50[b]	2.9±0.20[b]	4.45±0.65[a]	3.10±0.20[b]
Liver	47.55±0.35[a]	38.10±3.70[b]	51.40±11.20[a]	39.75±6.65[b]
Kidney	8.95±1.65[a]	8.55±1.85[ab]	9.10±0.50[a]	7.90±1.00[b]
Spleen	0.65±0.25	0.50±0.00	0.55±0.25	0.55±0.15
Testis	5.95±0.05[ab]	5.30±0.00[b]	6.40±0.10[a]	5.75±0.15[ab]
Ovary	0.20±0.00	0.20±0.00	0.40±0.00	0.10±0.00

Means with different superscripts in each row are significantly different (P<0.05).

Heart, liver, kidney and testis weight (Table 3) varied significantly (P<0.05), but spleen and ovary weight were not. In feeding trials, the use weights of some internal organs like the liver or kidneys as indicators of toxicity is a known common practice, because they should differ significantly if there was any serious effect of antinutritional factors on them being major detoxification organs (Sese and Berepubo, 1996; Farid, 2001). Such difference in weight is attributed to increased metabolic rate of the organs in attempt to reduce toxic elements or anti-nutritional factors to non-toxic metabolites (Sese et al., 2014). Although values from this study for these organs were significantly diffentent, with respect to the weight of heart, liver and kidney, yet these values conform with those reported for rabbits fed; sun-dried cassava waste (Olorunsanya et al., 2007), graded levels of pineapple waste meal (Adeyemi et al., 2010), boiled pigeon pea seed meal (Amaefule et al., 2005) concentrates, Aspilia africana and Tridax procumbens (Ojebiyi et al., 2013) and Mucuna utilis leaf meal (Sese et al., 2014). This suggest that the limits are within acceptable range, this notwithstanding, further studies to ascertain these anomaly is advocated.

Table 4. Haematological components of growers rabbits graded levels of costus afer

Parameters	T1(0%) Mean ± SE	T2 (5%) Mean ± SE	T3 (10%) Mean ± SE	T4 (15%) Mean ± SE	Sig
Hb (g/dl)	13.80±0.50	10.65±1.35	13.80±0.50	13.15±0.85	NS
PCV (%)	41.50±1.50[b]	32.00±4.00[b]	41.50±1.50[a]	39.50±0.85	*
RBC ($x10^{12}$/l)	7.25±0.25	5.75±0.75	7.30±0.10	7.10±0.30	NS
WBC ($x10^{9}$/l)	5.50±2.50	4.30±1.30	7.25±0.25	5.60±2.60	NS
MCH (pg)	19.00±0.00	18.00±0.00	18.50±0.50	18.50±0.50	NS
MCV (Fl)	57.00±0.00	55.50±0.50	57.00±1.00	55.50±1.50	NS
MCHC (g/dl)	33.00±0.00	32.00±0.00	33.00±0.00	33.00±0.00	NS
Neutrophils (%)	47.50±7.50	52.00±6.00	48.00±4.00	58.50±3.50	NS
Lymphocytes (%)	52.50±7.50	48.00±6.00	52.00±4.00	41.50±3.50	NS
Eiosinophils (%)	-	-	-	-	-
Monocytes (%)	-	-	-	-	-
Basophils (%)	-	-	-	-	-

Key: Haemoglobin (Hb), Packed Cell Volume (PCV), Red Blood Cell (RBC), White Blood Cell (WBC), Mean Cell Haemoglobin (MCH), Mean Cell Volume (MCV) and Mean Cell Haemoglobin Concentration (MCHC).

The effect of *C. afer* leaf meal on haematological parameters such as the White Blood Cell (WBC), Red Blood Cell (RBC), Mean Cell Haemoglobin (MCH), Haemoglobin (Hb) and Packed Cell Volume (PCV) were not significantly (p>0.05) different in the rabbits across the treatment groups. They are in agreement with normal range for

rabbits raised on ordinary concentrate (Burnett et al., 2003), rabbits fed concentrates, Aspilia africana and Tridax procumbens (Ojebiyi et al., 2013), rabbits fed sesame seed meal (Shah et al., 2007; Njidda and Isidahomen, 2010) and rabbits fed Mucuna utilis leaf meal (Sese et al., 2014). These values are also similar to normal physiological range for rabbits (Amata, 2010; Marco et al., 2003; Omoikhoje et al., 2006; RAR 2007; Njidda and Isidahomen, 2010).

IV. Conclusion

In conclusion, this study has shown that *Corstus afer* leaf meal had no detrimental effect on growth, internal organs and haematological indices of rabbits. Up to 10% of *Corstus afer* leaf meal can be included in the diet of growing rabbits without any adverse effects on performance and haematological characteristics.

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