Carcass and organ weight changes of weaner rabbits fed varying inclusion levels of dehulled African yam bean (*Sphenostylis stenocarpa*) soaked in wood ash solution

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Abstract

A total of thirty weaner rabbits were randomly allocated to five dietary treatments of six rabbits each in a completely randomized design to investigate the carcass yield and organ weight changes of weaner rabbits fed diets containing alkaline-soaked dehulled African yam bean (*Sphenostylis stenocarpa*) at 0 (control), 5, 10, 15 and 20% levels of inclusion. The rabbits were fed ad libitum for 56 days. The carcass yield showed that live weight, head, fore limbs, hind limbs, breast, back neck, pelt, tail and eviscerated weights were significantly affected ($P < 0.05$) by dietary treatments. Organ weight however showed that heart, lungs, kidney, whole intestine and caecum were significantly affected by dietary treatments ($P < 0.05$) and there was no significant ($P > 0.05$) difference in weights of liver, gall bladder and spleen across the dietary treatments. Results showed that rabbits on T1 had the highest value of live weight (586.5g), fore limb (13.10%), hind limb (14.50%) and neck (1.02%) while the lowest value of fore limb and hind limb was recorded for rabbits on T5 (6.26). Rabbits on T4 had the highest value of pelt (8.57%), tail (0.50%) and chest (8.82%). The lowest value was recorded for rabbits on T5 (5.36%), T2 (0.38%) and T1 (6.14) respectively. Rabbits on T1 had the lowest value of heart (0.05%), lungs (0.05%) whole intestine (2.50%) and caecum (2.16%) while the highest value of heart (0.46%), whole intestine (18.81%) and caecum (5.46%) was recorded for rabbits on T4 with rabbits on T5 having the highest value of lungs (0.51%). It can be concluded that dehulled AYB soaked in alkaline medium can be fed to weaner rabbits at 5% level of inclusion promoted good carcass yield and without having adverse effects on the internal organs. However, further processing methods needs to be adopted to improve the feeding quality of legume seeds.

Keywords: Dehulled African yam bean, alkaline medium, organ, rabbits**Introduction**

In Nigeria, soybean and groundnut cakes are the premium plant protein feedstuffs in livestock feed because of their high protein values and availability. These two feed ingredients are however competed for by human and industrial usage, therefore resulting in scarcity, high prices of feed and livestock products (Musalia *et al.*, 2005). This calls for the need to look for alternative protein sources that are cheaper and readily available. Dafwang (2006) had earlier

opined that evaluation of unconventional feed sources alongside other strategies would reduce pressure on the conventional feed ingredients and accelerate the attainments of feed security for monogastrics feeding. It is in light of the above that African yam bean, a non-conventional legume and under-utilized, is being considered for its feed values.

African yam bean (*Sphenostylis stenocarpa*) is a tropical leguminous plant with high seed and foliage yields. The crude

protein content of African yam bean seed ranges between 22-29% depending on stages of maturity. Oyawoye and Ogunkunle (1990) reported that the nutrient composition of African yam bean compares well with that of alfalfa.

Most of these non-conventional legumes even conventional legume seeds used in animal nutrition contain some anti-nutritional properties which negatively affect their utilization in raw or unprocessed forms by livestock. These substances, arising principally from secondary metabolism in plants are commonly referred to as anti-nutritional factors (ANFs). These ANFs reduce food intake and nutrient utilization in animals. They may also be hepatotoxic, neurotoxic and even lethal to farm animals were consumed (D'Mello, 1991). The anti-nutritional factors in African yam bean seeds include protease inhibitors, lectins, glycosides and tannins (Agunbiande and Longe, 1998). This limit the use of raw African yam Bean in livestock feed. Although various processing methods such as cooking, soaking, toasting, boiling, autoclaving and dehulling had been used to reduce the anti-nutritional factor content of the seed (Onyeike *et al.*, 1995) dehulling may further improve the use their use in animal feeding. Akinmutimi (2004) had observed that most processing methods employed in improving the feeding values of non-conventional or alternative feedstuffs do not completely eliminate ANFs but only reduce their concentration to tolerable levels in feedstuffs. D' Mello and Walker (1991) achieved considerable success by using alkaline potassium bicarbonate to detoxify jack beans as the relative ease with which canavanine was extracted from the whole beans indicated the complete solubilisation. Fernandez *et al.* (1993) observed that soaking of faba bean in 0.07%

sodium bicarbonate solution was more effective in decreasing the trypsin inhibitor activities of the bean. In this study the effect of soaking dehulled yam bean in a solution of ash on the carcass and organ weight changes of weaner rabbit was investigated

Materials and methods

Experimental site

The experiment was carried out at the Teaching and Research Farm, Oyo State College of Agriculture and Technology, Igboora, Oyo State.

Collection of sample

African yam bean seeds were purchased from Bodija Market, Ibadan, Oyo State, Nigeria

Pre-treatment of seeds

Raw African yam bean seeds were soaked at the rate of 1kg/3litres of water for 12 hours after which the water was decanted and the beans was dehulled and sun-dried for 3 days.

Treatment of sample

Dehulled African yam bean seeds were soaked at the rate of 1kg/3litres of 0.5% solution of wood ash for 24 hours, initial and final pH was taken.

Experimental design and Animal management

Thirty weaner rabbits were weighed and randomly assigned on the basis of body weight (40 ± 60 g) into five dietary treatments of 6 rabbits each in a completely randomized design experiment. Rabbits in each experimental animal group were allowed access to one of the five diets. Rabbits on T1-received the control diet (without ayb), T2-received 5% alkaline soaked dehulled African yam bean, T3-received 10% alkaline soaked dehulled African yam bean, T4-received 15% alkaline soaked dehulled African yam bean and T5-received 20% alkaline soaked dehulled African yam bean.

Table 1: pH changes of dehulled African Yam bean soaked in wood ash

pH range	DAYBSWA
Initial pH	8.1
Final pH	8.9

DAYBSWA - Dehulled African yam bean soaked in wood ash solution

Table 2: Gross composition of experimental weaner rabbit diets (%)

Ingredients	Diets				
	1 (0%)	(5%)	3 (10%)	4 (15%)	5 (20%)
Maize	42.00	41.02	39.94	38.93	37.91
Wheat offal	38.00	38.00	38.00	38.00	38.00
African yam bean	0.00	1.60	3.37	5.03	6.69
Soya bean meal	13.00	12.38	11.69	11.04	10.40
Oyster shell	4.00	4.00	4.00	4.00	4.00
Bone meal	2.00	2.00	2.00	2.00	2.00
Table salt	0.30	0.30	0.30	0.30	0.30
Vitamin premix*	0.25	0.25	0.25	0.25	0.25
L-Lysine	0.25	0.25	0.25	0.25	0.25
DL-Methionine	0.20	0.20	0.20	0.20	0.20
Total	100	100	100	100	100
Calculated Nutrients					
M.E (Kcal/kg)	250.88	2510.23	2518.21	2525.72	2532.81
C.P (%)	15.17	16.00	15.9	15.81	15.72

C. P- Crude protein, M. E- Metabolisable energy

*Composition of premix: Vit A 10,000,000IU, Vit D3 2000,000IU, Vit E 23,000mg, Vit K3 2,000mg, Vit B1 3,000mg, Vit B2 6,000mg, Niacin 50,000mg, Calcium pantothenate 10,000mg, Vit B6 5,000mg, Vit B12 25mg, Choline chloride 400,000mg, Biotin 50mg, Manganese 120,000mg, Iron 100,000mg, Zinc 80,000mg, Copper 8,500mg, Iodine 1,500mg, Cobalt 300mg, Selenium 120mg, Antioxidant 120,000mg

Parameters determined

At the end of the experiment, two rabbits per treatment were sacrificed by cervical decapitation for carcass evaluation and organ weight changes. They were fasted for eight hours bled, defured, eviscerated and dissected for determination of carcass weight. Cuts parts were weighed using sensitive scale and were recorded. The heart, lungs, liver, spleen and kidney were removed and weighed separately.

Statistical analysis

Data collected were subjected to statistical analysis of variance (ANOVA) using SPSS 2003 version and means separated by Duncan Multiple Range Test.

Results and discussion

The results of carcass yield of weaner rabbits fed dehulled African yam bean

based diets are shown in Table 4. Live weight, head, fore limbs, hind limbs, breast, lumber, back neck, fur, tail and eviscerated weight were significantly affected ($P < 0.05$) by dietary treatments. Results showed that rabbits on T1 had the highest value of live weight (586.5), fore limb (13.10%), hind limb (14.50%) and neck (1.02%) while the lowest values of fore limb and hind limb was recorded for rabbits on T5 (6.26%). Rabbits on T4 had the highest value of fur (8.57%), tail (0.50%) and chest (8.82%). The lowest value was recorded for rabbits on T5 (5.36%), T2 (0.38%) and T1 (6.14%) respectively. Table 5 showed the effect of varying levels of inclusion of alkaline soaked dehulled AYB on organs weight changes of weaner rabbits. The trend of the weights of spleen was similar to that of liver and gall bladder. While there was a

Carcass and organ weight changes of growing rabbits fed varying inclusion levels of dehulled African yam bean

significance ($P < 0.05$) difference in the value obtained for heart, lungs, kidney, whole intestine and caecum, there was no significant ($P > 0.05$) difference in liver, bile and spleen across dietary treatments. Rabbits on T1 had the lowest value of heart (0.05%), lungs (0.05%) whole intestine (2.50%) and caecum (2.16%) while the highest value of heart (0.46%), whole intestine (18.81%) and caecum (5.46%) was recorded for rabbits on T4 while rabbits on T5 had the highest value of lungs (0.51%).

Table 3: Proximate composition of experimental diets

Parameters	Diets				
	1(0%)	2 (5%)	3 (10%)	4 (15%)	5 (20%)
Dry matter	91.31	90.51	90.71	91.63	92.13
Crude protein	21.05	19.25	21.10	22.75	21.03
Ash	8.50	8.40	8.80	8.60	7.70
Ether extracts	7.20	7.13	6.90	7.10	7.06
Crude fibre	5.30	5.22	4.72	5.00	5.10

Table 4: Carcass characteristics of weaner rabbits fed varying levels of alkaline soaked dehulled African yam bean expressed as percentage of live weight

Parameters (%)	IETS					SEM
	(0%)	(5%)	(10%)	(15%)	(20%)	
Live weight (g)	586.5 ^a	529.5 ^b	423.0 ^d	396.5 ^e	447.5 ^c	20.02
Eviscerated weight	44.33 ^c	52.10 ^a	51.06 ^d	46.90 ^e	60.11 ^b	15.59
Head	12.40 ^a	12.50 ^b	13.20 ^c	13.10 ^c	11.80 ^d	3.66
Fore limbs	13.10 ^a	9.06 ^b	6.85 ^d	9.58 ^c	6.26 ^d	8.06
Hind limbs	14.50 ^a	11.14 ^b	12.50 ^d	11.80 ^b	6.26 ^e	8.27
Chest	6.14 ^a	6.61 ^c	7.32 ^d	8.82 ^b	8.49 ^c	1.02
Neck	1.02 ^a	0.85 ^d	0.70 ^c	0.88 ^d	1.00 ^b	0.46
Pelt	8.01 ^a	7.36 ^b	7.80 ^{cd}	8.57 ^c	5.36 ^e	3.38
Tail	0.43 ^{ab}	0.38 ^c	0.47 ^b	0.50 ^d	0.67 ^e	0.18

a, b, c, d, e: Means with different superscript on the same row are significant ($p > 0.05$)

Table 5: Organ weight changes of weaner rabbits fed alkaline soaked dehulled African yam bean expressed as percentage of live weight

Internal organs	Diets					SEM
	1 (0%)	2 (5%)	3 (10%)	4 (15%)	5 (20%)	
Heart	0.05 ^d	0.06 ^c	0.08 ^b	0.46 ^a	0.12 ^e	0.02
Lungs	0.05 ^e	0.06 ^d	0.08 ^c	0.12 ^b	0.11 ^a	0.04
Kidney	1.00 ^e	0.12 ^d	0.17 ^c	0.23 ^b	0.23 ^b	0.07
Liver	0.51	0.42	0.67	0.63	0.63	0.11
Gall bladder	0.02	0.02	0.02	0.03	0.02	0.02
Spleen	0.05	0.05	0.04	0.05	0.05	0.00
Whole intestine	2.50 ^d	3.01 ^c	2.97 ^e	4.74 ^a	4.15 ^{ab}	1.05
Caecum	2.16 ^e	2.93 ^d	4.11 ^c	5.46 ^a	4.32 ^b	1.38

a, b, c, d, e: Means with different superscript on the same row are significantly different ($p > 0.05$)

Table 6: Anti-nutritional factors composition of raw and processed AYB seed

Antinutrients	Tannin (mg/g)	Phytates (mg/kg)	T.I (TIU/mg)	Lectin (HIU/g)	Saponins (mg/g)	Oxalate (mg/g)
Raw AYB	0.09	0.57	31.67	58.24	0.32	0.25
DAYBSWA	0.05	0.32	0.06	6.35	0.21	0.12

DAYBSWA - Dehulled African yam bean soaked in wood ash, T.I- Trypsin inhibitor

The result of this research showed a significant ($p < 0.05$) difference in all the carcass parameters that were measured. Rabbits fed with control diet recorded the highest value of fore limbs, hind limbs and neck. Feeding of dehulled African yam beans soaked in alkaline medium at 5% level of inclusion showed better utilization of African yam bean by rabbits. Rabbits were able to utilize the nutrient in the feed and convert it into flesh at 5% inclusion level. This might be the level of anti-nutritional factors present at this inclusion level was minimal and does not have much negative effect on the carcass yield of the rabbits. The result of this research also suggested that the higher the inclusion levels, the higher the availability of the ANFs. Hence the processing method employed in this research could not completely eliminate anti-nutritional factors present in the tested ingredient (African yam bean). This result confirm the findings of (Akinmutimi, 2004) who observed that most processing methods employed in improving the feeding value of non-conventional or alternative feed stuffs does not completely eliminated anti-nutritional factors but only reduce their concentration to tolerable level in the feed stuffs.

The higher kidney weight for rabbits fed tested diets when compared with rabbits on T1 could be attributed to the effect of anti-nutrients. The liver and kidney are major detoxifying organs, hence enlargement and increase in weight as a result of increase in activity of the organs to detoxify residual anti-nutrient (Ologhobo *et al.*, 1993). The high value of kidney that was observed for rabbits on treatments 3, 4 and 5 indicated the diet fed has a higher content of ANF present, the increase in weight of the kidney agrees with the report of Ologhobo *et al.* (1993) who reported increase in the weight

of kidney of broiler fed raw lima bean and this was attributed to the fact that the key enzyme in cyanide detoxification (Rhodanase) in the kidney therefore increase muscular activity of the kidney might have led to an increase. Ahamaefule *et al.* (2006) also reported that weights of some internal organs like kidney, lungs, liver of animal may be used in animal feeding experiment as evidence of toxicity. Hence, presence of some anti-nutritional compounds could account for the increase liver weight in an attempt to detoxify them.

Conclusion

It could be concluded that at 5% level of inclusion the carcass yield was promoted and organ weight were not negatively affected when compared with rabbits fed the control diet.

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