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PERFORMANCE OF BROILERS FED GRADED DIETARY LEVELS OF RAW AFRICAN YAM BEANS (Sphenostylis stenocarpa)

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ABSTRACT

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The tolerant level of raw African yam beans was investigated using graded dietary levels of raw African yam beans on 150 broiler chickens. The birds were divided into five dietary treatments having 3 replicates of 10 birds per replicate in a completely randomized design. Diet one was corn-soybean- based while raw African yam beans meal was added to diets 2, 3, 4 and 5 at 5, 10, 15 and 20% respectively to replace maize and soybeans at ratio 3:2. At 8 weeks 2 birds per replicate were used to evaluate carcass characteristics. The growth performance was generally depressed with increased inclusion of raw African yam beans in the diet. The feed to gain ratio of birds placed on control diet was significantly lower ($p<0.05$) than others. The dressed weight and percentage dressed weight favored birds fed diet 1 (control diet), while, the prime parts (drumstick, thigh, and breast cuts) favored birds fed diet 5. The cost benefits favoured birds fed diet 1 with cost per kg weight of ₦217.43 as opposed to others. From the results of growth performance, carcass characteristics and cost per kg weight gain, raw African yam beans even if incorporated at 5% level of inclusion cannot replace soybean in corn-soybean based diet because performance of birds fed raw AYB will be far below that of those fed corn-soybean based diet.

INTRODUCTION

Poultry has been identified as a means of bridging protein intake deficiency in Nigeria. The broiler is a table bird or meat type bird and that is generally acceptable to majority of Nigerians. It is the quickest source of meat and its production is easily managed in relation to other livestock enterprise (Obioha, 1992; Ojo, 2002; Taiwo et al., 2005). Under good management, broiler chickens attain live weight of about 2 kg in about 7 weeks (Obioha, 1992). The main limitation to expansion of poultry industry is the availability of adequate supplies of needed feed ingredients at reasonable prices (Ani and Okorie, 2005; Babatunde and Hamzat, 2005). Feed account for about 70% of total cost of production (Ademola and Farinu, 2006). The high cost of feed is mainly due to the increasing competition between man and livestock for grains and conventional sources of plant (soybean, groundnut seed) and animal proteins (Adegbola, 1990; Emenalom, 2004).

The most promising way to solve the problem of competition between man and animal for plant protein is to identify cheaper and easily available feed stuff that are of low human preference and little or no industrial use that can meet nutritional requirements of poultry with or without processing (Akinmutimi, 2001;Fanimo et al., 2004; Fasina et al., 2004). One of such proteins (legume seeds) that has potential of being used in poultry feed is African yam bean (Sphenostylis stenocarpa).

African yam bean (AYB) is one of the lesser known legumes that is now coming into prominence in nutritional and agronomic research as an emerging food legume. It grows widely in the forest region of Nigeria but not fully exploited. The crude protein content of AYB ranges from 21.1-22.5% while amino acid profile is similar to that of soya bean (Ene-obong, 1992). African yam bean is high yielding and about 8.67 ton of seed per hectare was reported to be obtained in mixed cropping with yam, maize, okra and other vegetables (Phillips, 1972). The objective of this work is to determine the safe level of inclusion of raw AYB in the diet of broiler chicken.

MATERIALS AND METHODS

Location of the experiment

The experiment was conducted at the Poultry Unit of the Research and Training Farm of the Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria. Umudike is located on latitude 5° 29' and longitude 7° 32' East in the rain forest of zone of Nigeria. The environmental temperature of the region is characterized by a daily range of 27 and 35ɵC throughout the year and an average rainfall of 250 mm per annum.

Procurement of african yam bean (AYB)

AYB was purchased from Umuosu market in Isialangwa Local Government Area of Abia State of Nigeria.

Chemical analysis

The proximate composition of processed AYB were determined using the procedure described by the Association of Official Analytical Chemists (AOAC, 1990) while the gross energy was determined using Gallenkamp Ballistic bomb calorimeter.

Experimental diets

A total of five diets having crude protein ranging between 22.18 and 22.21% and caloric densities of between 11.89 KJ g^{-1} to 12.04 KJ g^{-1} were formulated as shown in Table 1 below. Maize was the major source of energy while soybean meal and AYB meal were the major sources of protein. The diets were fortified with synthetic amino acids such as lysine and methionine. The feed was presented in mash form. Diet 1 was corn-soybean based (control) while raw AYB meal was added to diets 2,3,4 and 5 at 5, 10, 15 and 20% respectively to replace maize and soybeans in ratio 2:3.

Table 1: Gross composition of experimental diets containing graded levels of raw African yam bean feed to broiler chicken from 2-8 weeks old

	Levels of inclusion of AYB				
Ingredients	D1 (0%)	D2 (5%)	D3 (10%)	D4 (15%)	D5(20%)
Maize	51.30	48.30	45.30	42.30	39.30
Soybean meal	28.00	26.00	24.00	22.00	20.00
African yam bean	0.00	5.00	10.00	15.00	20.00
Blood meal	2.00	2.00	2.00	2.00	2.00
Palm kernel cake	10.00	10.00	10.00	10.00	10.00
Fish meal	3.00	3.00	3.00	3.00	3.00
Bone meal	3.00	3.00	3.00	3.00	3.00
Oyster shell	2.00	2.00	2.00	2.00	2.00
Vit permit	0.25	0.25	0.25	0.25	0.25
Table Salt(NaCl)	0.25	0.25	0.25	0.25	0.25
DL-methionine	0.10	0.10	0.10	0.10	0.10
Lysine	0.10	0.10	0.10	0.10	0.10
Total calculated composition	100	100	100	100	100
Crude protein	22.21	22.21	22.23	22.21	22.18
Methionine	0.50	0.52	0.54	0.57	0.60
Lysine	1.69	1.90	2.10	2.31	2.51
Metabolizable energy kJg-1	12.04	11.99	11.94	11.89	11.89

Each 2.5kg of premix contains vit A (8.500,000iμ), D3(1,500000.00) vit E (10,000.00mg), k3 (1,50000mg), b1 (1,600.00mg), b2 (4000.00mg) Niacin (20,000.00mg), panthothenic acid (5,000.00mg), vit b6 (1500.00mg), vit B12(10.000.00mg), folic acid (500.00mg), Biotin (750,00mg), zinc (175,000mg), cobalt (200.00mg), copper (3000.00mg), lodine (1000.00mg), zinc (30,000mg) selenium (200.00mg) manganese (40,000.00), Iron (20,000mg).
D1, D2, D3D5 means Diets 1,2 ,3 ,4 and 5 respectively.

Experimental birds and management

One hundred and fifty unsexed broilers of Anak strain were bought from Zion farms Nigeria limited, Owerri, Imo State. They were brooded with kerosene stoves placed under metal hovers for 14 days in a deep litter house. Feed and water were supplied *ad libitum* to all the birds. At 14 days old, 30 chicks were randomly allotted to each of the 5 dietary treatments. Each treatment was replicated 3 times with 10 birds per replicate. The feed were offered *ad libitum* to all the birds throughout the period of the experiment. The birds were given necessary vaccination (intra-ocular, lasota, gumboro) and were also subjected to standard broiler management.

Experimental design and statistical analysis

The experimental design was completely randomized design. Data collected were subjected to analysis of variance (Steel and Torrie 1980). Means separation were carried out as described by Duncan's multiple range test (Duncan, 1955).

RESULTS AND DISCUSSION

The proximate composition and gross energy of experimental diets containing graded levels of raw AYB is as presented in Table 2. The crude protein contents of the feed ranged from 21.67 to 22.34%. This range is acceptable for broilers fed straight diets (Essien, 2010). All the parameters examined under performance of broiler chicken fed graded levels of raw AYB with the exception of the mean initial body weight were significantly ($P<0.05$) influenced by treatment diets (Table 3). The mean final body weight, mean total weight gain and mean daily weight gain followed similar pattern. Their values decreased as the quantity of AYB in the diets increased. These agreed with the work of Ojewola *et al*., (2006) and Okoye and Ihekoronye (2004), who recorded a similar pattern when raw AYB was fed to broiler chicken. This may be due to the presence of anti-nutritional factors such as trypsin inhibitors, phytic acid, tannin, saponin and hydrochloric acid found in raw AYB.

Tannin for example forms complex linkage with protein hence poor digestibility leading to loss of protein and hence poor growth (Akinmutimi, 2003). Phytic acid makes mineral unavailable for metabolic processes as it cheletes with them (Aletor and Fasuyi, 1997; Roberts *et al*., 2006) resulting in poor growth.

The mean total feed intake of birds ranged from 441.67 g (15% level of inclusion) to 506.78 g). (0% level of inclusion). The values of mean total feed intake observed for birds fed diets 1 (control) and those fed diet 2 (5% AYB) compared favourably with one another and were significantly higher than those in diet 3. Diets 4 and 5 were statistically similar. The same trend was observed for mean daily feed intake. The decrease in total feed intake and mean daily feed intake as the quantity of raw AYB increases in the diets agreed with the report of Ologhobo *et al*., (1993) and Ani and Okafor, (2004). The significant decreases in feed intake with increase in raw AYB might have resulted from anti-nutritional factors such as tannins and saponins present in AYB. Tannnins and Saponins confer bitter taste on feed thereby reducing palatability (Enzminger, 1990, Olomu 1995).

Feed to gain ration increased as the quantity of AYB increased in the diets with birds fed control diet having significantly ($p<0.05$) lower value than those fed other diets making diet 1 superior to other diets since the lower the feed conversion ratio the superior the diet (Ogbonna *et al*., 2000; Akinmutimi *et al*., 2008). The total weight gain of birds decreased as the quantity of AYB in the diet increase. Birds on diet one had superior total body weight gain (1707.00 g). This may be due to the fact that diet 1 was corn-soybean based.

Table 2: Determined Proximate Composition And Gross Energy Of Experimental Diets Containing Graded Levels Of Raw AYB Fed To Broiler Chicken From 2-8 Weeks Old.

Levels of inclusion of raw AYB					
Nutrients	D_1 (0%)	D_2 (5%)	D_3 (10%)	D_4 (15%)	D_5 (20%)
Dry matter(%)	90.61	90.35	90.49	90.58	90.27
Crude protein(%)	21.67	21.79	21.98	21.88	22.34
Ether extract(%)	4.12	3.97	4.05	3.92	3.87
Crude fibre(%)	5.29	5.35	4.87	4.95	4.56
Ash(%)	8.29	8.34	8.26	8.44	8.37
Gross energy (KJ.g)	16.67	16.63	16.68	16.59	16.59

Table 3: Growth Performance of Broiler Chicken Fed Graded Levels of Raw AYB

	Levels of inclusion of AYB					
Parameters	D_1 (0%)	D_2 (5%)	D_3 (10%)	D_4 (15%)	D_5 (20%)	SEM
Initial body weight (g)	41.00	41.00	41.00	41.00	41.00	0.00
Final body weight (g)	1750.00^a	1660.23^b	1464.56^c	1408.34^d	1316.34^c	16.21
Total weight gain(g)	1709.00^a	1679.23^b	1423.56^c	1367.34^d	1275.34^d	16.20
Total feed intake (g)	5065.78^a	5030.00^a	4641.66^b	4441.67^c	4456.87^c	33.34
Feed to gain ratio	2.96^d	3.11^c	3.24^d	3.24^b	3.48^a	0.32

Means within the same row with different superscripts (a-e) are significantly ($p<0.05$) different; SEM – Standard Error of Mean.

The carcass characteristics of broiler chicken fed graded levels of raw AYB is shown in Table 4.There were significant differences in all the parameters considered ($p<0.05$). The value of live-weight ranged from 1150 – 1775 g (DI). The live weight decreased significantly ($p<0.05$) as the quantity of AYB increased in the diets ($p<0.05$). As explained earlier, this could be due to increased accumulation of anti-nutritional factors, fibre and reduction in feed intake as the quantity of AYB increased. Feed intake is the major factor which influences weight gain (Ani and Okafor, 2004, Ani and Okeke, 2003, Plavinik *et al*., 1981). The values of de-feathered weight showed that broilers on D1 (control) performed better than the rest of the test diets, it was similar to D2 ($P<0.05$) but numerically higher.

Birds fed control diet which had significantly higher value in live-weight also had higher value (1500g) for dressed weight than the test diets ($P<0.05$). Birds on control diet had higher but comparable value of percentage dressed weight to those on diet 2 ($P>0.05$). All these showed the superiority of diets 1 to others. The high percentage dressed weight obtained for birds on treatment 1 and 2 over others implies that the composition of the live-weight is not made up of inedible offals (Oluyemi and Robbers, 2000). Diet 5 has superior values of prime parts (drumstick, thigh, breast) and they are significantly ($p<0.05$) better than others. Considering the overall parameters under carcass yield, birds fed control diet performed better than birds on other test diets. This suggests that corn-soybean based diet yield better result and that incorporating raw AYB as low as 5% does not compare favourably with control diet.

There were no significant ($p>0.05$) differences in the cost of total feed consumed, cost per kilogram feed and cost per kilogram weight gain(Table 5). The control diet had the lowest cost of feed per kilogram weight of meat (₦217.43) followed by diets 2 and 3 (₦363 and ₦280.95) respectively. The higher values of cost per kg weight gain of the birds obtained for broilers on test diet implies that much money was spent on them per Kg weight gain than the birds on control diet. The fact that the control diet had the least cost per kilogram weight gain shows that

incorporating raw AYB in the diet of broiler chicken even at a rate as low as 5% is not economical. This may be due to the presence of fibre and anti-nutritional factors w reduce the bioavailability and utilization of nutrients (Cryan *et al*., 1995).

Table 4: Carcass characteristics of broiler finisher fed different levels of raw AYB

	Levels of inclusion of raw AYB					
Parameters	D_1 (0%)	D_2 (5%)	D_3 (10%)	D_4 (15%)	D_5 (20%)	SEM
Live weight (g)	1775.00a	1515.00b	1325.00c	1200.00cd	1150.00d	44.08
Bled and defeathered weight (g)	1500.00a	1380.00ab	1175.40bc	1100.00c	930.00c	76.64
Dressed weight (g)	1235.00a	973.00b	825.00c	735.00c	685.37c	46.79
% dressed weight (g)	69.58a	64.36ab	62.26b	61.14b	57.50b	1.93
Wing (%)	14.88c	14.58c	18.40ab	21.95ab	22.69a	1.27
Thighs (%)	18.20b	22.20a	22.64a	20.51ab	21.81ab	1.13
Breast (%)	24.38a	26.44ab	30.78a	31.46a	32.04a	1.74
Back (%)	21.03b	23.47a	28.69a	26.99a	29.43a	1.33
Drumstick (%)	16.83c	20.95c	21.84b	25.17a	27.12a	1.36

Means within the same row bearing different superscript (a-c) are significantly ($p<0.05$) different SEM – Standard Error of Mean.

Table 5: Economic analysis of feeding graded dietary levels of Raw AYB to Finisher Broilers

	Levels of inclusion of AYB%					
Parameter	0(DI)	5(D2)	10(D3)	15(D4)	20(D5)	SEM
Cost of total feed consumed (₦)	363.66	372.09	337.57	325.82	327.59	13.61
costKg^{-1}wt gain(₦)	72.53	74.42	72.73	73.65	73.55	1.22
Cost k wt gain (₦)	217.43c	263.02b	280.75b	284.63ab	304.41a	6.89

Means within the same row bearing different superscript (a – c) are significantly ($p<0.05$) different; SEM – Standard Error of Mean.

The results of growth performance, carcass yield, carcass characteristic, and economics of broiler chicken fed raw AYB showed that raw AYB even at 5% level of inclusion cannot replace soybean (control diet) without deleterious effect.

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