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RESEARCH ARTICLE

PERFORMANCE OF BROILER CHICKENS FED VARIOUSLY PROCESSED AFRICAN YAM BEAN

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ABSTRACT

The performance of broiler chickens fed variously processed African yam bean was investigated using 150 broiler chickens. They were allotted into five dietary treatments having 3 replicates and 10 birds per replicate in a completely randomized design experiment. Five iso-caloric and iso-nitrogenous diets were formulated. Diet one was soy bean based (control) while diets 2, 3, 4 and 5 contained variously processed AYB (boiled, Toasted, Dehulled after toasted and Cracked and boiled) AYB meal at 5%. At the end of experiment, 2 birds per replicate were used for carcass characteristics and organ weights (expressed as percentage dressed weight).The growth performance showed no significant (P>0.05) difference among treatment means except for mean total and daily feed intake and mortality. The dressing percentage values fall within the normal range for all treatments except diet 4. Cut parts (PDW) favoured diet 4. The feed cost analysis favoured diet 2 with ₦224.48 cost/kg gain as opposed to others (T1 ₦ 227.42, T3 ₦ 233.59, T4 ₦ 226.50 and T5 ₦ 246.25). Considering the growth performance, mortality, carcass characteristics, and cost per kilogram weight gain of meat, diet 2 (5% boiled AYB) performed better than the other test diets and compared favourably with the control diet. Boiled AYB is therefore recommended.

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INTRODUCTION

The Food and Agricultural Organization of Nigeria (FAO, 2006) reported that Nigeria has reduced the number of people suffering from chronic hunger from 34% between 1995 – 1997 to 30% between 2003–2005. The report added that Nigeria was steadily moving towards achieving the target of reducing by half, the number of undernourished people by 2015 (Ekot, 2009). He also observed among others that enhancing productivity of small holder animal agriculture and creating enabling environment for private investment in animal agriculture as part of policy intervention needed to reduce hunger.

The major limitation to animal agriculture is feed. Feed accounts for about 70% of total cost of production (Ademola and Farinu, 2006) due to competition between man and livestock and poultry for conventional feed ingredient sources of plant (soybean, groundnut seed) (Emenalom, 2004). This has been the prime stimulant for searching for alternative feed ingredients. One of such that has the potential of being used in animal agriculture especially poultry feed is African yam bean (*Sphenostylis stenocarpa*).

African yam bean (*Sphenostylis stenocarpa*) 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 has not been fully exploited. The crude protein content of African yam bean ranges from 21.1 – 22.5% while the amino acid profile is similar to that of soybean (Ene-obong, 1992). African yam bean is high yielding, 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).Presence of anti nutritional factors such as tannin, saponnin, lectins, phytates, saponins, oxalates, tepernoid and cyanogenic glucoside (Njoku, 1991; Milton *et al.,* 2000; Emiola *et al.,* 2009).The need then for processing before usage. Processing methods such as boiling, toasting, cracking and dehulling are conventional processing methods. They therefore attract attention in this study. The objective of this study is to determine the best processing method (boiling, toasting, cracking/boiling, and toasting/dehulling) that would enhance good performance of broiler chickens.

MATERIALS AND METHODS

Location of the experiment

The experiment was carried out 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/ North and Longitude 7°32/ east in the rainforest zone of Nigeria. The climate of the region is characterized by a daily temperature range of 27°C and 35°C throughout the year and on average rainfall of 2000mm per annum.

Procurement and processing of African yam bean (ayb).

African yam bean (speckled, the more available one) was purchased from Umuosu market in Isialangwa Local Government Area of Abia State of Nigeria. The following methods were used for processing of AYB.

a) Toasting to brownness (for 15min)
b) Boiling in water for 30 minutes at 100 - 105^{0}C
c) Dehulling after toasting
d) Cracked and boiled using the same method as in b. The boiled, cracked and boiled AYB were sun-dried, and together with toasted / dehulled; toasted and Raw AYB were separately ground to fine (100µ mesh screen) powder and then stored until required.

Chemical Analysis

Proximate Composition and gross energy determination. 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.

Anti-Nutrient Determination

The method of Maga (1982), Lucas and Markaka (1975), Kakade *et al.* (1969), Knowles and Montgomery (1980) and Brunner (1985) was used to determine aic, phytic acid, trypsin inhibitors, hydrocyanic acid and saponin content of processed AYB meal respectively.

Experimental Diets

A total of five diets having percent crude protein ranging between 22.21 – 22.44 and caloric densities of between 11.74 to 12.04kj/kg were formulated as shown in Table .1 below. Maize was the major sources of energy while soybean meal and African yam bean meal were the major sources of protein. The diets were fortified with synthetic

amino acids such as lysine and methionine. Diet one was soyabean based (control) while the processed AYB meal was added to diets 2, 3, 4 and 5 at 5% respectively.

Experimental Birds and Management

A total of one hundred and fifty unsexed broilers of the Anak strain were purchased from Zion Farms Nigeria Limited. The birds 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 the birds. Thirty, 14 day old 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 experimental period. The birds were subjected to standard broiler management. Necessary vaccinations and medication were administered as at when due.

Experimental Design and Statistical Analysis

Experimental design was Completely Randomized Design. Data collected were subjected to analysis of variance (ANOVA) (Steel and Torrie, 1980). Means separation were carried out as described by Duncan's' Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

Table 2 presents the proximate composition and gross energy of experimental diets containing same levels (5%) variously processed African Yam Bean. The crude protein content of 20.57- 21.88 % is acceptable for broiler for a straight diet (Edet, 2008; Essien, 2010). Table 3 reveals the anti-nutritional factors in variously processed AYB. Boiled seeds were better detoxified than others. This was followed by cracked and cooked seeds. There were no significant differences ($P > 0.05$) in all parameters except for the total feed intake, mean daily feed intake and mortality. The total feed intake of diets 1 (control), 2 (boiled AYB) and 4 (cracked and boiled) were comparable ($P > 0.05$) but were significantly ($P < 0.05$) higher than those of diets 3 (toasted) and 5 (toasted and dehulled). The daily feed intake followed a similar pattern. Diets 1 (control) and 2 (boiled) had significantly ($P < 0.05$) lower values of percentage mortality than diets 3, 4 and 5. The higher feed intake observed for diets 2 (boiled) and 4 (cracked and boiled) attest to the fact that moist heating technique had the greater ability to detoxify the anti-nutrient component of the seed to a tolerable level (Akinmutimi, 2004). Boiled seed (for example) had the lowest percentage of saponin (Table 3). Saponins have been known to confer bitter taste

Table 1. Gross Composition of Experimental Diets Containing Same Levels (5%) of variously Processed African Yam Bean meal

	LEVELS OF INCLUSION OF AYB				
Ingredients	Control 0% (D1)	Boiled 5% (D2)	Toasted 5% (D3)	Cracked and Boiled 5% (D4)	Toasted and Dehulled 5% (D5)
Maize	51.30	47.30	47.30	47.30	47.30
Soybean	28.00	27.00	27.00	27.00	27.00
African Yam Bean	-	5	5	5	5
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. Premix *	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25
Methionine	0.10	0.10	0.10	0.10	0.10
Lysine	0.10	0.10	0.10	0.10	0.10
Total	100.00	100.00	100.00	100.00	100.00
Calculated composition					
Crude protein (%)	22.21	22.44	22.43	22.41	22.39
Methionine	0.50	0.53	0.53	0.53	0.53
Lysine	1.69	1.85	1.85	1.85	1.85
Metabolisable Energy (kJ/g)	12.04	11.99	11.97	12.04	11.77

**Each 2.5kg of premix contains vitamin A (8,500,000.00iu), Vitamin D_3 (1,500,000.00iu) Vitamin E (10,000.00mg), Vitamin K_3 (1,500.00mg), Vitamin B_1 (1,600.00mg), Vit. B_2 (4,000.00mg), Niacin (20,000.00mg), pantothenic acid (5,000mg), Vit. B_6 (1,500.00mg), Vit. B_{12} (10.00mg), Folic acid (500.00mg), Biotin (750.00mg), Zinc (30,000.00mg), Selenium (200.00mg), Manganese (40,000.00), Iron (20,000.00mg), Iodine (1000.00mg), Copper (3,000.00mg), Cobalt (200.00mg), Chlorine Chloride (175,000.00mg).*

Table 2. Proximate composition and gross energy of experimental diets containing same levels (5%) variously processed African Yam Bean meal

	LEVELS OF INCLUSION OF AYB				
Nutrients and Gross Energy	Control 0% (D1)	Boiled 5% (D2)	Toasted 5% (D3)	Cracked and Boiled 5% (D4)	Toasted and Dehulled 5% D5)
Dry matter (%)	90.21	90.32	90.14	90.38	90.49
Crude Protein (%)	21.88	20.79	20.57	21.29	21.15
Ether Extract (%)	3.86	3.78	3.74	3.95	3.91
Crude Fibre (%)	4.46	4.38	4.21	4.27	4.13
Ash	7.39	7.22	7.15	7.51	7.33
Nitrogen Free Extract	52.62	54.15	54.47	53.36	53.97
Gross Energy (KJ/g)	16.55	16.63	16.59	16.55	16.559

Table 3. Anti -nutritional Factors in Variously Processed African Yam Bean meal

	Boiled	Toasted	Cracked & Boiled	Toasted& Dehulled
Trypsin inhibitor (%)	0.00	1.05	0.00	0.65
Tannin (%)	0.60	0.64	0.56	0.52
Saponnin (%)	0.50	0.80	0.87	0.64
Hydrocyanic Acid (%)	0.00	5.08	0.00	3.17
Phytic Acid (%)	0.61	0.71	0.65	0.71

Table 4. Growth performance of Broiler chickens fed variously processed AYB meal

	LEVELS OF INCLUSION AYB(5%)					
	Control(0)	Boiled	Toasted	Cracked and Broiled	Toasted and Dehulled	SEM
final live weight (g)	1750.00	1740.42	1553.60	1650.00	1540.00	16.210
Initial body weight (g)	40.00	40.00	40.00	40.00	40.00	0.000
Total wt gain (g)	1710.00	1700.42	1513.33	1610.00	1500.00	16.196
Daily wt gain (g)	30.53	30.36	27.02	28.75	26.85	0.289
Total feed intake (g)	4740.00^{a}	4676.73^{a}	4460.00^{b}	4690.00^{a}	4398.00^{b}	33.337
Daily feed intake (g)	84.64^{a}	83.51^{a}	79.64^{b}	83.75^{a}	78.53^{b}	0.588
Feed to gain ratio	2.77	2.75	2.94	2.89	2.93	0.0316
Mortality (%)	0.67^{b}	0.67^{b}	2.33^{a}	2.33^{a}	3.00^{a}	0.730

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

Table 5. Carcass characteristics of broiler chickens fed 5% variously processed AYB meal

Parameter	*Control 0(D1)*	*Boiled 5(D2)*	*Toasted 5(D3)*	*Cracked and Broiled 5(D4)*	*Toasted And Dehulled 5(D5)*	*SEM*
Live weight (g)	1550.00^{a}	1500.00^{a}	1350.00^{b}	1200.00^{d}	1150.00^{d}	49.21
Defeathered weight (g)	1400.00^{a}	1350.00^{a}	1200.00^{b}	1150.00^{d}	1065.00^{d}	44.14
Dressed weight (g)	1175.00^{a}	1050.00^{b}	920.00^{c}	750.00^{d}	775.00^{d}	21.83
Dressing %	75.81^{a}	70.00^{ab}	66.950^{b}	62.50^{b}	67.39^{b}	2.33
Wings (%)	11.49^{b}	9.99^{b}	11.06^{b}	15.08^{a}	13.88^{a}	1.27
Thighs (%)	13.49^{b}	14.56^{b}	14.65^{b}	16.87^{a}	15.09^{a}	1.13
Breast (%)	22.55^{bc}	25.09^{ab}	26.63^{a}	27.43^{a}	20.84^{c}	1.74
Back (%)	17.02^{b}	18.76^{ab}	17.98^{b}	22.33^{a}	19.42^{ab}	1.33
Drumsticks (%)	12.77^{b}	15.12^{a}	15.46^{a}	14.45^{a}	14.19^{ab}	1.36

Means within the same row having different superscript (a - d) are significantly (P < 0.05) different. SEM – Standard Error of Mean. PDW – Percentage Dressed Weight

Table 6. Cost of inclusion of 5% variously processed AYB meal in the diets of broiler chickens

	LEVEL OF INCLUSION OF AYB					
Parameter	Control	Boiled (5)	Toasted (5)	Cracked and Boiled	Toasted and Dehulled (5)	SEM
	D1	D2	D3	D4	D5	
Cost of total feed consumed (₦)	343.99	340.35	324.68	341.38	320.00	10.7333
Cost / kg feed (₦)	72.57	72.79	72.59	72.78	72.79	1.1929
Cost / kg wt gain of meat (₦)	227.42^{b}	224.48^{b}	233.587^{b}	260.50^{a}	246.25^{ab}	7.0265

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

and reduce palatability. The non significant (P0>0.5) difference in feed intake among diets 1, 2 and 4 also support the reason given above. The significantly lower mean total feed intake and daily feed intake (P < 0.05) observed for diets 3 (toasted) and 5 (toasted and dehulled) agreed with the report of Ojewola *et al.* (2006) who observed that toasting is not very efficient in detoxifying grain legumes. Toasting and toasting and dehulling had the lowest reduction of the different anti-nutritional factors (Table 3). The residual anti-nutritional factors such as saponin and tannin confer bitter taste and reduce palatability (Olomu, 1995) and hence reduction in feed intake. This reduction in feed intake and poor nutrient availability and utilization could probably account for the numerically lower values of final body weight, total weight gain and daily weight gain of birds fed diets containing toasted seed and toasted and dehulled. The feed to gain ratio showed no significant difference but numerically support diet 2 (boiled AYB). The percentage mortality observed for control diet and diet 2 were significantly (P<0.05) lower than those for diets 3, 4 and 5. This supports the superiority of the boiling as a processing technique over others.

The carcass characteristics of broiler chickens expressed as percentage dressed weight are as shown in Table 5. There were significant differences (P<0.05) in all the parameters considered. Birds fed control diet had significantly higher values for live weight, defeathered weight, dressed weight and percentage dressed weight than those fed test diets except T2 but with the exception of dressed weight. The live weight of the bird fed Diet 2 (boiled) was higher than those of diets 3, 4 and 5. The defeathered weight, dressed weight and percentage dressed weight followed the same pattern.

When the values of cut parts were expressed as percentage dressed weight, the values for wings and thighs were significantly higher in diets 4 and 5 (P < 0.05). Diets 3 and 4 had higher values for breast while diet 5 had the least (20.84%). The value for back ranged from 22.33% to 17.02% with diet 4 (cracked and boiled) having the highest while diet 1 (control) the least. The values of drumstick ranged from 12.77% to 15.46%. Diets 2, 3 and 4 had values that compared favourably with one another. These value were higher but similar to diet 5 (P < 0.05). The results showed that the cut part values favoured diet 4. Considering the live weight, the defeathered weight, dressed weight, dressing percentage, thigh, breast, back –cut and drumsticks, T2 compared favourably with both control and other test diets. Feed cost analysis of dietary inclusion of 5% variously processed AYB is as presented in Table 6. There were significant (P0<0.5) differences for the values of cost per kg weight gain only. It ranges from ₦ 22.48 (Diet 2) to ₦ 260.50 (Diet 4). D1, D2, D3 and D5 were statistically similar to one another but significantly lower (P<0.05) than D4 except D5. The higher value of D4 for cost per Kg weight gain could be attributed to poor weight gain in relation to the cost of feed consumed. Since the lower the cost per kg weight gain, the better the diet in terms of economic viability (Ojewola *et al*., 2006) making diet 2 a choice diet.

Conclusion

Considering the growth performance (feed to gain ratio, percent mortality), carcass characteristics and cost per kilogram weight gain of meat, diet 2 (5% boiled AYB) performed better than the other test diets and compared favourably with the control diet. Boiled AYB is therefore recommended.

REFERENCES

A.O.A.C. 1990. Association of Official Analytical Chemists. Official Methods of Analysis 5th ed. Washington DC.

Ademola, S.G. and Faniru, G.O. (2006). Performance of laying birds fed diets containing forage meal of *Tithonia diversifolia* and antibiotics. *Nig. J. of Animal Prod*., 33 (1): 58-68.

Akinmutimi, A. H. 2004. Evaluation of sword bean (*Canavalia gladiata*) as an alternative feed resource for broiler chicks. Ph.D. Thesis, College of Animal Science and Animal Health, Michael Okpara University of Agriculture, Umudike. Pp 4 – 17.

Brunner, J. R. 1985. Evaluation of haemaglutinating activity of low-temperature cooked kidney beans. J. Fd. Sc., 50: 78 – 81.

Duncan 1955, Multiple Range and Multiple Tests, Biometrics 11:1-42

Edet, J. 2008. Evaluation of Toasted *Mucuna sloanei* meal as feed ingredient to broiler diets. A project report. Michael Okpara University of Agriculture, Umudike.

Ekot, O. E. 2009. Animal Agriculture in Nigeria and the Global Food Challenge Keynote address at the 34th Anima Conference of the Nigerian Society for Animal Production held in Uyo, Nigeria March 16-19.

Emenalom, O. O. 2004. "Comparative performance of broiler chicks fed diets containing differently processed *Mucuna pruriens* seed meals. Nig. J. Animal Prod.,31 (1): 12 – 16.

Emiola, I. A., Ojebiyi, O. O., Oladunjoye, I. O., Slominski, B. A. and Nyachotti C. M. 2009. Effect of multi-carbohydrate enzyme supplementation on performance and nutrient digestibility in growing pigs fed barley/wheat DDGS – Based diet. Proceeding of Nig. J. of Anim. Prod. 34: 382 – 385.

Ene-Obong, H. N. 1992. Nutritional Evaluations, Consumption Pattern and Processing of the African Yam Bean (*Sphenostylis stenocarpa*). Ph.D Thesis, Department of Home Science and Nutrition, University of Nigeria Nsukka, Enugu State, Nigeria.

Essien U. N. 2010. performance of broiler chicken fed graded levels of raw and dehulled Mucuna sloanei meals as substitute for soya bean meal. MSc Thesis, Michael Okpara University of Agriculture, Umudike.

Food and Agriculture Organisation (FAO 2006). State of Food Insecurity in the world, FAO, Rome.

Kakade, M. I., Rachis, J. J., Meghee, J. E. and Puski, 1969. Determination of Trypsin inhibitor activity of soy products. A collaboration analysis of improved procedure. Cereal Chem. 151 – 371.

Knowles, W. and Montgomery, R. D. 1990. Toxic constituents of plant food stuff 2nd ed. Academic Press, New York. Pp. 10 – 15.

Lucas, G. M. and Markaka, P. 1975. Phytic acid and other phosphorus compounds of bean (*Phaseolus vulgaris*). J. Agric. Ed. Chem. 23 (1): 13 – 15.

Maga, J. A. 1982. Phytate. Its Chemistry occurrence, Food interaction, nutritional significance and method of Analysis. *J. Agric. Food Chem.*, 30:1

Milton, F.B.,Marjatta, E., Rolf, Mayhrman, R., Carew, L.B. and Robert J.C. 2000. Food and feed for *Mucuna*. current uses and the way forward. Proceedings of International Workshop. Kenya.

Njoku, H. O. 1991. Production of Tempeh from the African Yam Bean and wheat flours. B. Tech. Thesis. Fed. Uni. Of Tech, Owerri, Nigeria.

Ojewola, G. S., Otteh, J. O., and Abasiekong, S. F. 2006. Effect of African Yam Bean (*Sphenostylis stenocarpa*). Meal-Based Diets Supplemented at varying levels with Nutrase-Xyla Enzyme on Broiler Starter. Agric. J. 1 (3): 172 – 175.

Olomu, J. M. 1995. Monogastric Animal Nutrition Principles and Practice (1st Ed.). A Jachem Publication, Benin City, Nigeria 320 pp.

Phillips, T. A. 1972. An Agricultural Notebook Longmans, Nigeria.

Steel, R.G. and TOrrie, J.H. 1980. Principal and procedures of statistics A Biometric Apprach and Edition MCGram Hill Book Co.