Agricultural Journal 1(3): 172-175, 2006

Effect of African Yam Bean (Sphenostylis Stenocarpa) Meal-Based Diets Supplemented at Varying Levels with Nutrase-Xyla Enzyme on Broiler Starter

Ojewola, G.S., J.O. Otteh and S.F. Abasiekong
Michael Okpara University of Agriculture, Umudike College of Animal Science and Animal Health, Department of Non- Ruminant Animal Production
P.M.B. 7267, Umuahia. Abia State Nigeria

Abstract: African Yam Bean (AYB) meal and Nutrase-xyla enzyme were evaluated for their nutritive and economic efficiency in broiler starter diets. Six diets were formulated, a control (D_1) and five others. AYB meal and fish meal were the major plant and animal protein sources. Diets 2,3,4,5 and 6 were supplemented with nutrase-xyla enzyme at 10 g/100 kg, 20k g/100 g, 30 g/100 kg, 40/100 g and 50 g/100 kg diet, respectively. The calculated percent crude protein of the diets was 25 while metabolizable energy was 3100kcal/kg. One hundred and forty-four (144) day-old unsexed Anak 2000 strains of broiler chicks were used for the trial. Each treatment consisted of 3 replicates of 8 birds in a Completely Randomised Design (CRD). The experiment lasted 5 weeks. The results showed that the mean body weight gain and feed-to-gain ratio were significantly ($p<0.05$) depressed. D_1 had the highest body weight gain (603.02g) while diets 2,3,4,5 and 6 were 331.66g 300.83g, 300.56g, 342.36g and 341.25, respectively. The total revenue realizable from Diet 1 (N361.81) was significantly ($p<0.05$) higher than the other diets. It was therefore concluded that the use of AYB meal with or without nutrase-xyla enzyme supplementation is not efficient and research efforts need be made towards the provision of appropriate characterization of AYB carbohydrate, protein and anti-nutritional components to allow for development of appropriate enzymes and toxin binders that could enhance their nutritive value and utilization.

Key words: African yam bean meal, nutrase-xyla enzyme, broiler chicken

INTRODUCTION

African yam bean (AYB) is one of the under-utilized legumes found in Nigeria[1], Central African Republic, Gabon, Zaire and Ethiopia[2]. It is high yielding, about 866,666kg/ha (8.67 ton per hectare) and was reported to be obtained in mixed cropping with yams, maize, okra and other vegetables[3].

Kine *et al.*[4] observed that AYB contain percent crude protein that ranged from 21-29 with 3270 kcal/kg. Metabolizable energy. And the amino acid composition indicates that its methionine and lysine levels are equal to or better than those of soyabean[5]. Limiting the efficiency of AYB use is the inherent anti-nutritional factor[6,7], which according to Elegbede[8] form insoluble complexes with such divalent ions as Fe^{++}, zn^{++}, thus making them unavailable for absorption. The authors later profer solutions such as toasting and pre-cooking of the seeds.

Sonaiya[9] stated that increasing animal food production and harnessing the livestock resources in Nigeria for economic empowerment will require, among other actions, addressing the major yield-reducing factors affecting farmers' livestock by blending traditional improvement approaches with innovative technologies. Biotechnology is a continuum of technologies. Among such technologies is the enzyme technology which has become an issue of importance in animal nutrition in the recent years. This is because many fibrous alternative feed ingredients, however, require enzyme supplementation to maximize their potential, and also improved the quality of the environment by reducing nitrogen output of excreta and pollutants.

Eruvbetine[10] contributing, stated that enzymes application in poultry diet perform some or all of the following functions: maintain performance on poorer quality diets, decrease formulation cost, widen range of raw materials (feed stuffs), overcome inconsistency and anti-nutritional factors of raw materials, decrease nutrient and water excretion and encourage better economic returns. Derbyser[11], on the other hand was more specific. He stated effect of nutrase enzymes as producing efficient cleavage of Non-Starch Polysaccharides (NSP), decrease of intestinal viscosity, increase of availability of nutrients, increase of energetic value of the ration and less digestire problems.

Corresponding Author: Ojewola, G.S., Michael Okpara University of Agriculture, Umudike College of Animal Science and Animal Health, Department of Non- Ruminant Animal Production P.M.B. 7267, Umuahia. Abia State Nigeria

This study was designed to evaluate the nutritive potential and economic efficiency of AYB supplemented with untrase-xyla enzyme.

MATERIALS AND METHODS

The study was carried out in the poultry unit of the Teaching and Research Farm, Michael Okpara University of Agriculture, Umudike. Abia State. Nigeria (5°29[1]N and 1.7° 32L).

Test ingredients: AYB purchased from a local market in Ebonyi State, Nigeria was subjected to toasting, after which they were milled using hammer mill. Nutrase xyla enzyme was purchased from one of the major poultry feed companies in Lagos, Nigeria. The nutrase-xyla enzyme contain endo-1,4-B-ylanase. It is designed for rations high in arabinoxylans and its normally used in ratios, containing 40 to 65% wheat and its by-products[12,13].

Experimental diets: The diets were formulated as shown in Table 1. Diets 1,2,3,4,5 and 6 had AYB meal and fish meal as the major plant and animal protein sources. Diet 1, the control treatment had no nutrase-xyla enzyme, while Diets 2,3,4,5 and 6 were supplemented with Nutrase-xyla enzyme at 10 g/100 kg. 20 g/100 kg, 30 g/100 kg, 40 g/100 kg and 50g/1000kg diet, respectively.

Experimental birds and design: One hundred and forty four (144) day-old unsexed Anak 2000 Strains of broiler chicks were obtained from Hybro farms, Port-Harcourt, Rivers State, Nigeria. The chicks were divided into 24 birds per treatment. Each treatment consisted of 3 replicates of 8 birds each in a Completely Randomized Design (CRD). The experiment lasted 5 weeks. The diets were fed to the birds from day-old ad-libitum. Routine management practices such as vaccination, drug administration and maintenance were religiously carried out.

Response criteria: The mean weekly live weight changes and feed intake were recorded. The mean daily weight gain and feed-to-gain ratio were calculated from the data obtained. The cost (N/k g) effectiveness of the dietary ingredients was also calculated.

Statistiscal analysis: The data obtained were subjected to the analysis of variance as described by Steel and Torrie[14]. The Duncan's Multiple Range Test[15] was used to detect differences among means.

RESULTS AND DISCUSSION

The results of the productive performance of broiler chickens fed AYB meal-based diets containing varying levels of nutrase-xyla enzyme is shown in Table 2. All the parameters examined with exception of the initial body weights, were significantly influenced ($p<0.05$) by the treatmet diets. The mean final body weight gain and feed efficiency were significantly depressed ($p<0.05$) by the treatment diets, despite, the supplementation with nutrase-xyla enzyme. This could be due to the fact that

Table 1: Ingredient composition of the six different diets

	Diets					
Ingredients	1	2	3	4	5	6
Yellow maize	57.00	57.00	57.00	57.00	57.00	57.00
African Yam bean meal (toasted)	30.00	30.00	30.00	30.00	30.00	30.00
Fishmeal (Local)	6.00	6.00	6.00	6.00	6.00	6.00
Bone meal	4.00	4.00	4.00	4.00	4.00	4.00
Oyster shell	2.00	2.00	2.00	2.00	2.00	2.00
Salt	0.25	0.25	0.25	0.25	0.25	0.25
*Vitamin Mineral Premix	0.25	0.25	0.25	0.25	0.25	0.25
Lysine	0.10	0.10	0.10	0.10	0.10	0.10
Methionine	0.10	0.10	0.10	0.10	0.10	0.10
Nutrase-xyla enzyme	+ -	0.010	0.020	0.030	0.040	0.050
Total 1	100.00	100.00	100.00	100.00	100.00	100.00

Calculated analysis Crude protein (%) 25% Metabolizable energy (ME) 3100kcal kg^{-1}.

- % provide the following: 2.5 kg/1000 kg feed: Vitamin A (15,000,000 I.U), Vitamin D3 (3,000,000,000 I.U), Vitamin E (30,000.I.U.), Vitamin K (2,500 I.U), Thiamin: B1 (2,000 mg) Riboflarin: B2 (10,000 mg), Folic acid (1,000 mg), Biotin (80 mg), Chloride (500 mg), antioxidant (125 g) Manganese (96g), zinc (60 g), Iron (24 g), copper (6 g), Iodine (1.4 g), Selenium (250 g), cobalt (120 g)

Table 2: Performance of broiler chickens fed african yam bean-meal-based diet supplemented at varying levels with nutrase-xyla enzyme (0-35day)

	Diets						
Parameters	1	2	3	4	5	6	SEM
Mean initial weight (g)	46.43	46.42	49.17	46.66	45.42	48.75	1.04^{NS}
Mean final body weight(g)	659.45^{a}	377.08^{b}	350.00^{b}	347.22^{b}	387.78^{b}	390.00^{b}	50.64
Mean final body weight gain(g)	603.02^{a}	331.66^{b}	300.83^{b}	300.56^{b}	342.36^{b}	341.25^{b}	93.94
Mean daily feed intake (g)	82.31^{bc}	76.65^{c}	81.66^{bc}	88.45^{ab}	82.18^{bc}	94.30^{a}	2.70
Mean total feed intake (g)	2880.95^{bc}	2682.74^{bc}	2858.13^{bc}	3095.66^{b}	2876.48^{bc}	3300.60^{a}	93.94
Feed-to-gain ratio	4.96^{b}	8.20^{ab}	9.74^{a}	10.52^{a}	8.75^{ab}	10.25^{a}	1.19

abcd means within a row with different superscripts are significantly different ($p<0.05$)

Table 3: Feed cost analysis of Broiler chickens fed African Yam Bean meal-based diets Supplemented at varying levels with nutrase-xyla enzyme (0-35days)

	Diets						
Parameters	1	2	3	4	5	6	SEM
Feed cost per kg body weight (N)	419.08^{b}	673.49^{ab}	828.73^{a}	893.76^{a}	744.32^{ab}	872.56^{a}	102.95
Feed cost per body weight gain (N)	739.80^{b}	2089.93^{ab}	2883.60^{a}	3106.29^{a}	2341.24^{ab}	2851.14^{a}	600.34
Total cost per chicken (N)	322.14^{bc}	307.91^{c}	321.07^{bc}	241.52^{bc}	323.20^{bc}	359.60^{a}	7.90
Total Revenue (N)	361.81^{a}	199.00^{b}	179.90b	180.33^{b}	205.40^{b}	204.65^{b}	29.60

abc means within a row with different superscripts are significantly different ($p<0.05$)

appropriate characterization of AYB carbohydrate, protein and anti-nutritional components are yet to be properly determined. Thus, making it impossible for development of appropriate enzymes and toxin binders to enhance their nutritive value and utilization, especially, where enzymes are substrate specific. Secondly, it could also be attributable to the residual anti-nutritional factor such as tannin and trypsin inhibitors, which has been reported to have negative effects on weight gain[16,17]. Though, toasting has been reported to have a partial detoxification on grain legumes such as Jackbean and Sword bean[18,19], such effect is absent in this trial. Lastly, according to Nutrex[13] Nutrase is often used in corn-soy or wheat based rations rather than AYB.

Mean total feed intake was also significantly ($p<0.05$) affected by the treatment diets, though, they were all comparable, only with the exception of birds fed diet 6. It seems therefore, that the assumed idea that the fowl eats primarily to meet its energy requirements[20] is true to an extent in this case. This could also be due to the fact that both the dietary energy and crude protein are the same except for the enzyme and secondly, the highest feed intake observed in diet 6 might be associated with the high level of enzyme supplementation. Diet 1 is the most efficient of all the diets, but diets 2, 3, 4, 5 and 6 were significantly inefficient. This may be attributable to the fact that AYB in the presence of the nutrase xyla enzyme might have formed a chemical complex that complicated the digestion and efficient utilization of the diets.

The economics of production is shown in Table 3. According to Ojewola[21], the relative advantage of using any diet has to be determined by the price of the ingredients at the time of use and the current price of live and dressed chickens in such environment. The various parameters considered were significantly influenced (p<0/05) by the treatment diets. Total revenue realizable from diet 1. is significantly ($p<0.05$) higher than others. An indication that Diet 1 is economically advantageous when compared to others.

In conclusion, the use of nutrase-xyla enzyme in AYB meal-based diets was not efficient. This does not in anyway, foreclose biotechnology intervention options for addressing the constraints of using AYB in poultry nutrition. Rather, more research efforts may be required in characterization of AYB's carbohydrate protein and anti-nutritional components, so as to allow for development of appropriate enzymes that can enhance the nutritive value and utilization of AYB. And, in commercial situations, it is worth considering the practical value of using multienzyme complexes (targeting one feed) instead of substrate-specific enzymes (targeting one ingredient).

REFERENCES

1. Aletor, V.A. and O.O. Aladetimi, 1989. Compositional evaluation of some cowpea varieties and ome under utilized edible legumes in Nigeria. Dicnahrung, 33: 999-1007.
2. Dalzial, M.J.M., 1995. The useful plants of West Tropical Africa crown. Agents for Overseas Government London.
3. Philips, T.A., 1992. An agricultural Notebook Longmans. Nigeria.
4. Kine, B. B., O.U. Eka, C.Y. Aremu and U. Esien, 1991. Comparative Studies on the food qualities of African Yam bean (Sphenostylis stenocarpa) and compea (Vigna unguiculata). Trop. J. Appl. Sci., pp: 65-70.
5. Evans, I.M. and D. Boulter, 1974. Amino acid composition of seed meals, yam bean (sphenostylis stenocarpa) and lima bean (Phaseolus lunatus). J. Sci. Fd. and Agric., 25: 919-922.

6. Njoku, H.O., 1991. Production of Tempeh from the African Yam bean and wheat flours. B. Tech. Thesis. Fedral University Technology Owerri Nigeria.
7. Ofunya, C.O., H.O. Njoku and I. Eli, 1991. Development of cheese-like product from the African yam bean (Sphenostylis stenocarpa). Food chemistry, 39: 197-204.
8. Elegbede, J.A., 1998. Legumes. In Nutritional Quality of plant foods. (Eds. Osagie. A.U. and Eka. O.U.). Ambik Press. Benin City. Nigeria, pp: 53-83.
9. Sonaiya, E.B., 2005. Potential Biotechnology Applications in the Feed Industry in Nigeria. Invited Symposium paper presented at the opening session of the 30th annual conference of the Nigerian Society for animal production held at the University of Nigeria Nsukka, Enugu State, 20th-24th.
10. Eruvbetine, D., 2005. Review of the activities of feed enzymes use in Nigeria: What does the farmer need. pp: 1-6.
11. Debyser, I., 1999. Nutrase, First Quality feed enzymes. Nutrex. Achterstenhoek. www.nutrex.be.
12. Nutrex, 2000. Nuvisol Hatch. Water Soluble vitamins. Nutrex. Achterstenhoek www.nutrex.be.
13. Nutrex, 2003. Nutrisol. Improving digestibility Nutrex. Achterstenhoek. www.nutrex.b.
14. Steel, R.G.D. and J.H. Torrie, 1980. Principle and Procedures of Statistics. A biometrical approach. 2nd Edition. McGraw-Hill, New York, pp: 67.
15. Gomez, A.K. and A.A. Gomez, 1985. Statistical procedure for Agricultural Research. Wiley and Sons Inc. New York.
16. Aletor, V.A. and A.O. Fasuyi, 1997. Nutrient Composition and processing effect on cassava leaf (Manihot esculent, cranzi) anti-nutrient. Paper presented at 2nd annual conference of Animal Science Association of Nigeria. Lagos, pp: 231-242.
17. Akinmutimi, A.H. 2003. The effect of various processing method on proximate, gross energy and mineral composition mucuna utilis seed. Proc. Of the Nigeria society for animal production held at IAR and T, Ibadan, pp: 166-168.
18. Ewa, E., 1999. Evaluation of the Metabolizable energy and the true digestible protein of Jack bean (canavalia ensiformis) using Musscovy duck (Cairina muschata). M.Sc. Thesis. Michael Okpara University of Agriculture. Umudike, pp: 55-83.
19. Amaefule, K.U. and F. Obioha, 2001. Performance and nutrient utilization of broiler Starters fed diets containing raw boiled or dehulled pigeon pea seeds (cajanus cajan). Nig. J. Anim. Prod., 28: 31-39.
20. Oluyemi, J.A. and F.A. Roberts, 2000. Poultry Production in warm wet climates. Spectrum books limited. Ibadan, pp: 153-157.
21. Ojewola, G.S., 1993. Productive Performance and body Composition of broilers as influenced by dietary energy and protein in the Humid tropics. Ph.D. Thesis. Dept. Animal Science, University of Ibadan, Nigeria.