EFFECT OF FEEDING GRADED LEVELS OF ENZYME (NATUZYME®) TREATED AND UNTREATED BAMBARA GROUNDNUT OFFALS ON GROWTH PERFORMANCE AND CARCASS CHARACTERISTICS OF FINISHER BROILER CHICKENS

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Abstract
Effect of enzyme (Natuzyme) fortification of Bambara groundnut (*Voandzeia subterranea* L) offal diet on growth performance and carcass characteristic of finisher broiler chickens was investigated. One hundred and eighty nine (189) day old commercial broiler chicks were randomly divided into 7 groups of 27 birds each. The groups were randomly assigned to diets in a 3 × 2 factorial arrangement involving four levels (0, 10, 20 and 30%) of treated and untreated Bambara nut offal with control diet (0) in a complete randomized design. Each treatment was replicated three times with nine birds per replicate. Results showed that increasing levels of treated and untreated Bambara nut offal in the diets increased ($P < 0.05$) average daily feed intake and feed cost per kg weight gain, but decreased ($P < 0.05$) final body weight, average daily weight gain, feed conversion efficiency and protein efficiency ratio. Final body weight and average daily weight gain of control diet, feed conversion ratio at the 10, 20 and 30% treated and untreated Bambara groundnut offal levels, and reduced average daily feed intake and feed cost per kg weight gain at all the Bambara groundnut offal (BGO) inclusion levels. The results of the study indicate that 20% Bambara groundnut offal treated and untreated can be included in broiler diet without adverse effects on broiler chickens and also to reduce cost of production.

Key words: Bambara groundnut offal, dietary enzyme, broiler chickens, performance, carcass

Introduction

High cost of feed is a limitation to monogastric animal production in Nigeria which has been rated at 70 - 80 percent of total cost of production (Madubuike and Ekenyem, 2001). Consequently, the fight to reduce the cost of poultry production becomes critically urgent in order to salvage Nigerians from the scourge of sub-optimal animal protein intake and malnutrition. With the food situation rapidly worsening, the poultry industry has a key role to play in many parts of the world as a most economical source of protein (Augusto *et al.*, 1999). The poultry industry is one of the fastest growing segments of the livestock industry. Poultry are highly prolific and very efficient in converting feed nutrients into high quality animal protein (Smith, 2001). It is therefore very important to use unconventional materials such as cowpea waste, soybean waste, bambara nut offal, etc., that are locally available and can be obtained at lower prices. The inclusion of graded levels of raw bambara nut (*Voandzeia subterranea L*) offal in the diets of broiler chickens will help to enhance production by reducing the cost of production. Bambara nut is widely cultivated in the Northern and Southern States of Nigeria where the seeds are processed into flour and consumed as moi moi (Enwere, 1998). The processing of the seeds into flour results in the production of the waste that contains 16.40% crude protein (Okeke, 2000). Bambara nut waste has been used in the feeding of poultry and rabbits (Okeke, 2000; Ani and Okafor, 2004; Ani, 2007). However, its use in the feeding of monogastric animals is limited by the presence of high fibre and antinutritional factors such as protease inhibitors, haemaglutinins, tannins, cyanogenic glycosides and flatulence factors in the raw bean (Ensminger *et al*, 1996; Enwere, 1998). Poultry cannot fully utilize high fibre diets because they lack the digestive framework that can elaborately digest large amount of fibre. It becomes imperative, therefore, to incorporate exogenous enzymes into their diets in order to enhance the breakdown of the non-starch polysaccharides (NSPs) present in fibre (Doku and Karikari, 1981; Ensminger *et al.*, 1996; Enwere, 1998). Besides antinutritional factors, another limitation is its high fibre content. The enzyme being considered in this study is Natuzyme which has been shown to increase digestibility of fibrous feed ingredients by disrupting the plant cell walls, and by reducing the viscosity of the gut contents, thereby enhancing nutrient absorption (Choct and Annison, 1992; Bedford *et al.*, 1992; Acromovic, 2001). The present study was therefore conducted to determine the effects of graded levels of raw bambara nut waste and supplementary enzyme (Natuzyme) on the growth performance and carcass characteristics of finisher broiler chickens.

Results and Discussion

The effect of feeding different levels of enzyme treated and untreated BGO in finisher diet of broiler chicken is as shown in TTable 1

Table 1: Effect of feeding diet containing enzyme treated or untreated BGO on finisher growth characteristics of broiler chicken (Treatment effect)

	Treatment						
Parameter	T_1	T_2	T_3	T_4	T_5	T_6	T_7
AIW	41.90±0.10	41.90±0.15	42.00±0.00	41.87±0.13	42.00±0.00	41.90±0.10	42.00±0.00
AFW	2605.09±61.38^{bcd}	2865.74±31.68^{a}	2772.22±58.35^{ab}	2526.30±65.86^{de}	2720.37±41.86^{abc}	2388.89±60.94^{e}	2587.73±44.18^{cd}
AWG	2563.19±61.29^{bcd}	2823.78±31.75^{a}	2730.22±58.35^{ab}	2484.43±65.91^{de}	2678.37±41.86^{abc}	2346.99±60.86^{e}	2545.73±44.18^{cd}
ADWG	40.68±0.97^{bcd}	44.82±0.51^{a}	43.34±0.93^{ab}	39.44±1.05^{de}	42.51±0.66^{abc}	37.25±0.97^{e}	40.41±0.70^{cd}
ATFI	5806.70±24.74^{d}	6442.62±112.12^{a}	6023.61±18.05^{c}	6109.85±60.12^{bc}	6104.39±39.31^{bc}	6248.11±26.12^{bc}	6136.20±74.43^{b}
ADFI	92.17±0.39^{d}	102.26±1.78^{a}	95.61±0.29^{c}	96.98±0.96^{bc}	96.90±0.62^{bc}	99.18±0.41^{b}	97.4±1.18^{bc}
FCR	2.27±0.05^{ab}	2.28±0.02^{ab}	2.21±0.06^{a}	2.46±0.09^{ab}	2.28±0.02^{ab}	2.66±0.07^{c}	2.41±0.07^{b}
PI	18.44±0.08^{d}	20.45±0.36^{a}	19.12±0.05^{c}	19.40±0.19^{bc}	19.38±0.12^{bc}	19.84±0.08^{b}	19.48±0.24^{bc}
PCR	0.45±0.01^{ab}	0.46±0.00^{abc}	0.44±0.01^{a}	0.49±0.02^{c}	0.46±0.00^{abc}	0.56±0.01^{d}	0.48±0.01^{bc}
PER	2.21±0.05^{ab}	2.19±0.02^{abc}	2.27±0.05^{a}	2.03±0.07^{cd}	2.22±0.04^{ab}	1.88±0.05^{d}	2.07±0.06^{bc}
F. cost/Kg	332.94±8.08	326.52±2.48	327.54±8.16	338.81±13.85	323.37±3.27	323.37±3.27	326.84±9.55

^{abcde}--- Means with different superscript along the same row are significantly ($p<0.05$) different
T_1-Control T_2-0BGO+250mg enzyme T_3-10%BGO+mg enzyme T_3-10%BGO + 250mg Enzyme T_4-20%BGO + 0mg Enzyme T_5-20%BGO +250mg Enzyme T_6-30%BGO +0mg Enzyme T_7-30%BGO +250mg Enzyme AIW-Average initial weight AFW -Average final weight AWG-Average weight gain ADWG-Average daily weight gain ATFI-Average total feed intake ADFI-Average daily feed intake FCR-Feed conversion ratio PCR Protein conversion ratio PI-Protein intake PER-Protein efficiency ratio Fcost/kg -feed cost per kilogram.

The average daily weight gain was significantly ($p<0.05$) different across the various treatment groups as treatment 2 had the highest value (44.82g) while treatment 6 had the least value (37.25 g). Average daily feed intake was highest in treatment 2 (102.26 g) and differed significantly ($p<0.05$) from the other treatment groups with the least value (92.17 g) found in treatment 1(Control group). Feed conversion ratio was also significantly ($p<0.05$) different across the treatment groups. Treatment 3 had the best feed conversion (2.21) while Treatment 6 had the least feed conversion ratio (2.66). Feed cost per kilogram feed produced was not significantly ($p<0.05$) affected by different levels of enzyme treated and untreated BGO.

The effect of feeding different levels of enzyme treated and untreated BGO in diet of broiler chicken on carcass and organ characteristics is shown in Table 2. Treatment 5 had the best dressed weight and dressing percentage (2203.00 g and 81.65 % respectively) while the least values were observed in treatment 1 (1849.67 g and 72.07 % respectively). Breast weight was higher in treatment 5 (809.67 g) and least in treatment 1 (641.00 g).Back weight highest in treatment 3 (351.67 g) while the least value is in treatment 1 (289.67 g). Thigh weight was highest in treatment 3 (322.67 g) and least in treatment 6 (245.67 g). Drum stick weight was best in treatment 5 (335.67g) while treatment 6 had the least value (265.00 g). The Wing weight was highest in treatment 2 (240.00 g) and least in treatment 7 (203.00 g). Neck weight was highest in treatment 3 (181.67 g) and least in treatment 6 (147.67 g). Head weight was highest in treatment 3 (57.67 g) while the least and similar values were observed in treatment 4 and 7. Shank weight was highest in treatment 5 (118.00 g) and least in treatment 7 (84.67 g). Liver weight was highest in treatment 5 (49.67 g) and least in treatment 3 (38.67 g). Gizzard weight was highest in treatment 4 (69.67 g) and least in treatment 7 (53.00 g).

Table 2: Effect of feeding diet containing graded levels of enzyme treated or untreated BGO on carcass/organ characteristics of broiler chicken (Treatment effect).

	Treatment						
Parameter	T_1	T_2	T_3	T_4	T_5	T_6	T_7
Live wt.	2566.67 ± 33.33^{ab}	2733.33 ± 66.67^{a}	2733.33 ± 66.67^{a}	2566.67 ± 88.19^{ab}	2700.00 ± 57.74^{a}	2400.00 ± 57.74^{b}	2600.00 ± 0.00^{a}
Evis. wt.	1974.33 ± 4.67^{c}	2275.67 ± 18.76^{ab}	2313.00 ± 2.31^{a}	2195.00 ± 42.72^{ab}	2382.67 ± 1.47^{a}	1997.67 ± 103.05^{c}	2091.67 ± 109.99^{bc}
D. wt.	1849.67 ± 22.81^{c}	2108.00 ± 14.43^{ab}	2140.67 ± 0.88^{ab}	2052.00 ± 38.68^{b}	2203.00 ± 27.14^{a}	1852.00 ± 86.60^{c}	2022.67 ± 55.56^{b}
Dressing %	72.07 ± 0.46^{b}	77.22 ± 1.20^{ab}	78.41 ± 1.97^{a}	80.07 ± 2.06^{a}	81.65 ± 1.48^{a}	77.08 ± 1.76^{ab}	77.80 ± 2.14^{ab}
Back wt.	289.67 ± 2.03^{d}	335.67 ± 11.26^{ab}	351.67 ± 2.03^{a}	320.00 ± 19.63^{bc}	321.67 ± 4.33^{bc}	292.67 ± 3.76^{cd}	301.67 ± 0.88^{cd}
Thigh wt.	274.33 ± 6.36^{b}	318.00 ± 6.35^{a}	322.67 ± 4.91^{a}	278.00 ± 0.58^{b}	302.67 ± 8.95^{ab}	245.67 ± 12.99^{c}	279.67 ± 14.15^{b}
Drum stick	267.33 ± 3.53^{c}	307.00 ± 10.39^{ab}	318.00 ± 2.89^{ab}	283.67 ± 6.64^{bc}	335.67 ± 3.18^{a}	265.00 ± 21.94^{c}	269.67 ± 12.99^{c}
Wing wt.	204.00 ± 4.51^{b}	240.00 ± 4.62^{a}	237.67 ± 2.60^{a}	216.00 ± 1.15^{ab}	229.67 ± 0.88^{ab}	204.00 ± 12.12^{b}	203.00 ± 17.90^{b}
Neck wt.	155.33 ± 0.33^{de}	166.00 ± 5.77^{c}	181.67 ± 0.33^{a}	162.00 ± 0.57^{cd}	174.00 ± 1.15^{b}	147.67 ± 2.60^{e}	152.00 ± 1.15^{e}
Head wt.	51.00 ± 2.08^{b}	57.33 ± 0.33^{a}	57.67 ± 0.33^{a}	50.67 ± 1.45^{b}	58.33 ± 0.33^{a}	56.00 ± 1.15^{a}	50.67 ± 3.18^{b}
Shank wt.	79.33 ± 3.28^{bcd}	109.00 ± 4.04^{abc}	114.33 ± 0.88^{ab}	19.67 ± 2.60^{cd}	118.00 ± 5.20^{a}	95.67 ± 11.84^{cd}	84.67 ± 4.33^{d}
Liver wt.	47.00 ± 0.58^{ab}	43.67 ± 1.45^{b}	38.67 ± 3.18^{c}	48.00 ± 1.15^{ab}	49.67 ± 0.33^{a}	45.67 ± 0.33^{ab}	46.67 ± 0.88^{ab}
Gizzard wt.	56.33 ± 1.45^{cd}	66.00 ± 3.46^{ab}	57.67 ± 2.03^{cd}	69.67 ± 2.03^{a}	58.67 ± 2.03^{bcd}	62.67 ± 2.03^{abc}	53.00 ± 2.89^{d}
Pancreas wt.	3.33 ± 0.33^{b}	5.67 ± 0.33^{ab}	3.67 ± 0.33^{b}	6.67 ± 0.33^{a}	4.67 ± 0.33^{ab}	7.00 ± 73^{a}	4.67 ± 0.33^{ab}
Spleen wt.	1.67 ± 0.33^{b}	1.67 ± 0.33^{b}	3.00 ± 0.58^{ab}	3.00 ± 0.58^{ab}	5.00 ± 0.00^{a}	4.67 ± 1.76^{a}	3.00 ± 0.58^{ab}
Heart wt.	9.00 ± 0.58^{de}	10.00 ± 1.15^{cd}	11.67 ± 0.33^{bc}	13.00 ± 0.58^{ab}	13.67 ± 0.33^{a}	12.00 ± 0.58^{ab}	8.00 ± 0.00^{e}
S. intestine	208.00 ± 8.72	209.00 ± 4.62	221.67 ± 3.18	211.00 ± 4.04	200.67 ± 15.30	207.67 ± 1.45	209.67 ± 0.33
L. intestine	13.00 ± 0.58	13.67 ± 0.33	13.00 ± 0.58	13.67 ± 0.33	13.00 ± 0.58	13.00 ± 0.58	13.00 ± 0.00
Caecum int.	38.67 ± 1.76^{ab}	42.00 ± 1.15^{ab}	37.67 ± 0.33^{ab}	37.33 ± 0.33^{b}	43.67 ± 3.76^{a}	43.67 ± 2.00^{a}	39.00 ± 1.73^{ab}

abcde--- Means with different superscript along the same row are significantly (p<0.05) different

T_1-Control T_2-0BGO+250mg enzyme T_3-10%BGO+mg enzyme T_3-10%BGO + 250mg Enzyme T_4-20%BGO + 0mg Enzyme T_5-20%BGO +250mg Enzyme T_6-30%BGO +0mg Enzyme T_7-30%BGO +250mg Enzyme Wt.-Weight Evis.-Evisceration S-Small L-Large int.-Intestine

Pancreas was highest in treatment 6 (7.00 g) and least in treatment 1 (3.33 g). The spleen weighed highest in treatment 5 (5.00 g) while the list and similar value was found in treatment 1 and 2 (1.67 g). Heart weight was found to be highest in treatment 5 (13.67 g) and the least value was found in treatment 7 (8.00 g). The caecum was similar and highest in treatment 5 and 6 (43.67 g) and least in treatment 4 (37.33 g). Feed intake decreased significantly as BGO inclusion level increased beyond 10%. This result agrees with earlier report of Onyimonyi and Onukwufor (2003), who replaced soybean meal and maize with bambara groundnut offal in broiler diets. They further reported that bambara groundnut offal could replace the 2 feedstuffs up to 10% in the diets without adverse effect on feed intake of broiler chickens. The control treatment group, treated and untreated diets had lower fibre content and therefore birds on the control diets had the highest feed intake values when compared with the other diets. According to Ani (2007) poultry cannot utilize high fibre diets fully because they lack the digestive framework that can elaborately digest large amount of fibre. In the finisher phase, the birds fed diets containing treated BGO consumed more feeds than those fed with untreated BGO. This was attributed to improved energy availability and utilization for the growth of poultry (Odetallah *et al.*, 2005 and Wang *et al*., 2005). Results of the carcass parameters showed significant differences ($P < 0.05$) between treatments for the live weight, carcass weight and dressed weight, head and shank weight, wings, thigh and breast had significant differences ($P < 0.05$). There was a consistent reduction in the values of parameters as the inclusion level of BGO increased beyond 20%. As shown in Table 2, the marked effect of dietary levels of BGO had significant ($p<0.05$) effect on live body weight, dressed carcass weight and carcass dressing %, especially as the level of BGO in the diets increased beyond 20 %. Perhaps the increased anti-nutritional factors (ANFs) in the Bambara groundnut offal could have been responsible for the observed reduction (Huisman and Tolman, 1990). The slaughter weights of birds, plucked weight (dressed weight), eviscerated-carcass percentage, dressing percentage and internal organs were significantly different ($P<0.05$). Birds fed on diets containing BGO dressed better than those fed control diet.

Conclusion and Recommendation

The result of this study showed that raw Bambaranut offal can be incorporated in broiler chicken diet at 20% inclusion level, without any deleterious effect on the performance of the birds. The study also showed that raw bambara groundnut offal can be used to supplement soya bean meal and maize in broiler chicken diets .Further investigation should be done in determining the proper inclusion rate of BGO as a feed resource.

Reference

Acromovic, T. (2001). Commercial application of enzyme technology for poultry production. World Poult. Sc. J. 57:225-242.

Ani, A.O. 2007. Effect of raw bambara groundnut (voandzeia subterranean L) waste on performance of growing rabbits. Agroscience J. Tropical Agric, Food Environ and Extension, 6 (1): 89 - 97

Ani, A.O. and Okafor, I.C.(2004).Nutritional evaluation of raw Bambara groundnut waste (Voandzeia subterranean L) waste for weaner rabbits. Proc. 29th Ann. Conf. Nig. Soc. for Anim. Production (NSAP), March 21st – 25th 2004, Usman Danfodiyo Univ. Sokoto, Nigeria pp 183 – 186.

Augusto, A.A., Cuca, C.M. and Pino J.A. (1999) Poultry Nutrition in Latin America with Special Reference to Scientific Poultry Raising In: Animal production in the Tropics. (eds) Loosli, J.K.., Oyenuga, V.A., and Babatunde, G. M. Trade Island Nigeria, Ltd, Lagos. Pp 213-226.

Bedford,M.R. Smith,C.H. M.Veldman A,Versteng and Beynene, A.C (1992).Dietary carboxymethylcellulose with high instead of low viscocity reduces macronutrient digestion in broiler chicken. J. Nutr. 127: 483-487. Carsten, P. 2013. Reduction of anti-nutritional factors in (pre) starter feed. All About Feed (international magazine on Animal Nutrition, Processing and Feed Management). Volume 21 – No 2 – 2013. Pp 25-27.

Choct, M. and Annison, G. (1992). Anti-nutritive effect of wheat pentosans in broiler chickens. Role of Viscosity and gut microflora. Brit. Poul. Sc.33: 821-834.

Doku, J.A. and Karikari, O.O. (1981).Tropical Grasses. Legume Bull.31:20-27.

Ensminger, M.E, Oldfied, J.E. and Heinemann, W.N. 1996) Feeds and Nutrition. The Ensminger publishing Coy; Clovis Califomia, USA PP. 324-366.

Enwere, N.J. 1998. Foods of Plant Origin. 301 pp (Afro-orbispub. Ltd. Nsukka Nigeria).

Huisman, J. and G. H. Tolman (1990). Anti-nutritional factors in the plant protein diets for non-ruminants, Eds. P. C. Garnsworthy, W. Haresign and D. J. A. Cole. In: Recent Advances in Animal Nutrition. Butterworths/Heinemann. London.

Madubuike, F. N. and Ekenyem, B. U. (2001) Non-Ru- minant livestock production in the tropics Gust-Chuks Graphic Centre, Owerri, Nigeria, 196.

Odetallah, N. H., J. J. Wang.,. J. D. Garlich and J. C. H. Shih. (2005). Versazyme Supplementation of Broiler Diets Improves Market Growth Performance. Poultry Science 84: 858–864.

Okeke, D.P. (2000). Replacement of soybean meal with bambara waste (*Voandezia subterranea*) in broiler diets. M.Sc. Thesis Dept. of Anim. Sci. University of Nigeria, Nsukka.

Onyimonyi, A.E. and J.O. Onukwufor, 2003. Effects of toasted Bambara groundnut *(Voandzia subterranean (L.) thouras)* waste (TBW) on performance of growing pullets. Proceedings of the 28th Annual Conference of the Nigerian Society for Animal Production (NSAP), 28: 237-239.

Smith, A.J. (2001) Poultry. The Tropical Agriculturalist. Revised Macmillan Education Ltd. London. Pp 1-11.

Wang, Z. R., S. Y. Qiao., W. Q. Lu and D. F. Li. (2005). Effects of Enzyme Supplementation on Performance, Nutrient Digestibility, Gastrointestinal Morphology, and Volatatile Fatty Acid Profiles in the Hindgut of Broilers Fed Wheat-based Diets. Poultry Science 84: 875–881.