Performance of broilers fed enzyme-supplemented tigernut (*Cyperus rotundus* L.) meal diets

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ABSTRACT

A feeding trial was set up to study the effects of replacing maize with tigernut meal (TGN) at 0, 33.33, 66.67 and 100 per cent levels, with 0.10 per cent enzyme supplementation of all levels, on performance characteristics and carcass yield in broiler chicken for 8 weeks (56 days). A total of 200 Anak-2000 breed of broilers were randomly allotted to four experimental diets such that each treatment had two replicates of 25 birds each. Tigernut meal inclusion at 33.33 per cent (Diet 2) with enzyme supplementation resulted in significant final live weight and carcass yield, while tigernut meal significantly (P<0.05) depressed feed intake, weight gain, feed/gain ratio, and carcass yield at 66.67 and 100 per cent replacement levels. Inclusion of TGN significantly (P<0.05) resulted in higher level of fat being deposited in carcass. Inclusion of tigernut meal in the diets did not result in mortality. The results, therefore, showed that TGN could replace up to 33.33 per cent of maize without any detrimental effect on growth performance and carcass characteristics.

Research and development note: Received 30 Aug 03; revised 9 Oct 04.

RÉSUMÉ

BAMGBOSE, A. M., AWOSANYA, O., OJO, O. T. & OSO, A. O.: *Rendement des poulets de chair nourris des régimes supplémentaires de l'enzyme de la farine de souchet comestible* (Cyperus rotundus *L.*). Un essai d'alimentation s'est déroulé pour étudier les effets de remplacement de maïs avec la farine de souchet comestible (FSC) à 0, 33.33, 66.67 et 100 pour cent niveaux avec 0.10 pour cent d'enzyme supplémentaire de tous les niveaux sur les caractéristiques de rendement et carcasse de rendement des poulets de chair pour 8 semaines (56 jours). Une totalité de deux cents des poulets de chair de l'espèce Anak-2000 étaient assignés au hasard aux quatre régimes expérimentaux tellement que chaque traitement avait deux replicatifs de 25 volailles chacun. L'inclusion de la farine de souchet comestible à 33.33 pour cent (Régime 2) avec l'enzyme supplémentaire menait à un rendement considérable de poids vif final et de carcasse, alors que la farine de souchet comestible réduisait considérablement (P < 0.05) la consommation d'aliment, gain de poids, proportion de gain/aliment et le rendement de carcasse à 66.67 et 100 pour cent des niveaux de remplacement. Inclusion de FSC menait considérablement à un niveau plus élevé de la déposition de la graisse en carcasse. Inclusion de la farine de souchet comestible dans les régimes ne menait pas á la mortalité. Le résultat, donc, montrait que FSC pourrait remplacer jusqu'à 33.33 pour cent du maïs sans aucun effet nuisible sur le rendement de croissance et les caractéristiques de carcasse.

Introduction

Poultry production in Nigeria has been one of the most popular enterprises which helps to reduce malnutrition, particularly protein deficiency in the diets of individuals. Ideally, the different classes of birds should be provided with nutritionally complete food, balanced in various calories, protein, and minor dietary constituents that will guarantee maximum rate of growth, efficiency of feed use, and optimum productivity. In broiler diet, the bulk of energy is supplied by either maize, sorghum, or millet. These grains are in high demand as staple human food in most developing countries; thus, leading to high cost of grains for

use in poultry feed (Obioha, 1975).

Animal nutritionists in Nigeria are now paying attention to the use of by-products and waste products of crop and animal origin for compounding livestock and poultry feed; hence, the use of tigernut (*Cyperus rotundus* L.) meal as replacement for maize in broiler diet.

Furthermore, high crude fibre content of tigernut (*Cyperus* bulbs) meal necessitates the need to supplement such feed with enzymes to degrade the high fibre content for better use and improved performance of broilers (Bamgbose *et al.*, 1998)

Materials and methods

Proximate analyses were applied according to the methods of AOAC (1990). Four diets were formulated such that TGN replaced maize at 0, 33.33, 66.67 and 100 per cent replacement levels with enzyme supplementation of all experimental diets (Table 1). The diets were formulated to contain 20.07, 19.89, 19.70, and 19.50 per cent crude protein, respectively. Feed and water were provided *ad libitum* (Table 2). A total of 200 day-old broiler chicks (Anak-2000) of 35g average weight were randomly assigned to four diets with replicates of 25 broilers per dietary treatment.

TABLE 1

Chemical Composition of Maize and TGN (%)

Parameter	*Maize*	*TGN*
Metabolizable energy (kcal g^{-1})	3.43	2.10
Determined (DM-basis)		
Dry matter	94.24	89.06
Crude protein	9.75	8.88
Crude fibre	2.05	8.35
Ether extract	3.98	17.37
Ash	1.30	4.44
Nitrogen-free extract	78.16	51.06
Calcium	0.02	0.16
Phosphorus	0.29	0.06

AOAC (1990)

The experiment lasted for 8 weeks (56 days). Weekly records of feed intake, body weight gained, and mortality were kept. At the end of the experiment, a total of 16 birds were used for carcass evaluation, with two birds randomly selected per treatment and kept off feed for 12 h. The procedure for cutting into pieces was as outlined by Oluyemi & Roberts (1979). The data collected were analyzed by analysis of variance in a completely randomized design, while means were separated by the New Duncan's Multiple Range Test (DMRT) (Steel & Torrie, 1980).

Results and discussion

Table 1 shows the chemical composition of maize and tigernut meal (TGN). The meal contained 8.88 per cent crude protein, 8.35 per cent crude fibre, 17.37 per cent ether extract, and 4.44 per cent ash; while maize had 9.75 per cent crude protein, 2.05 per cent crude fibre, 3.98 per cent ether extract, and 1.30 per cent ash. Higher crude protein value was recorded for maize, while TGN had higher values for fat, fibre and ash.

Table 3 shows that Diet 1 (0 % level of inclusion) had the highest daily intake followed by Diet 2 (33.33 % level of inclusion), but decreased as the level of TGN was increased in Diets 3 and 4, respectively. The high fibre content possibly reduced the birds' performance at 33.33 per cent.

Fibre in diet of monogastrics impairs the use of other nutrients, especially crude protein (Onifade & Babatunde, 1996).

Onifade (1993) reported that fibrous agro-industrial wastes are potentially valuable as feed stuffs; nevertheless, they have the associated problem of signification and also of being a barrier to microbial digestion.

Weight gained followed a trend similar to feed intake. Diets 1 and 2 recorded the highest values, which reduced steadily in Diets 3 and 4; indicating that as the level of crude protein in the diet decreased from Diet 1 to Diet 4, the weight gain decreased. This agrees with Eshiet, Omole & Adegbola's (1979) report that increasing protein concentrate of diets results in increased growth

TABLE 2

Experimental Diets for Broilers (%)

Ingredient	*Level of replacement (%)*			
	0	*33.33*	*66.67*	*100*
	Diet			
	1	*2*	*3*	*4*
Maize	50.00	33.33	16.67	0.00
TGN	0.00	16.67	33.33	50.00
Soybean cake	25.00	25.00	25.00	25.00
Fish meal	2.00	2.00	2.00	2.00
Wheat offal	18.40	18.40	18.40	18.40
Bone meal	2.50	2.50	2.50	2.50
Oyster shell	1.50	1.50	1.50	1.50
Salt	0.25	0.25	0.25	0.25
*Premix	0.25	0.25	0.25	0.25
Enzyme	0.10	0.10	0.10	0.10
	100.00	100.00	100.00	100.00
Metabolizable energy (MJ kg^{-1})	11.72	11.09	10.42	9.79
Determined (DM-basis)				
Crude protein (%)	20.07	19.80	19.70	19.50
Ether extract (%)	3.61	5.84	8.07	10.29
Crude fibre (%)	4.21	5.27	6.33	7.38
Ash (%)	3.67	4.18	4.70	5.22
Calcium (%)	0.86	0.88	0.91	0.93
Phosphorus (%)	0.73	0.82	0.92	0.99
Dry matter (%)	84.72	84.25	83.75	83.22

*To provide the following per kg of feed: Vitamin A 10,000 IU; Vitamin D3 2000 IU; Vitamin B1 0.75 g; Vitamin B2 5 g; Nicotinic acid 25 g; Calcium pantothenate 12.5 g; Vitamin B12 0.015 g; Vitamin K3 2.5 g; Vitamin E 25 g; Biotin 0c acid 0.05 g; Folic acid 1 mg; Chlorine chloride 250 g; Cobalt 0.400 g; Copper 8 g; Manganese 64 g; Iron 32 g; Zinc 40 g; Iodine 0.8 g; Flavormycin 100 g; Sprianycin 5 g; 3-Nitro 50 g; DL-Methionine 50 g; Selenium 0.16 g; L-Lysine 120 g; BHT 5 g.

rate. However, no significant differences ($P>0.05$) were recorded in feed/gain and protein efficiency ratios in broilers fed the experimental diets.

The results showed that some carcass characteristics and dressing percentage were significantly ($P<0.05$) influenced by graded levels of TGN. The plucked weight, eviscerated weight, and dressing percentage were highest for Diet 1, while least values were recorded for Diet 4. As broilers are efficient feed converters (Table 4), a poor diet will result in tissue being poorly deposited; hence, poor edible meat. This may not be connected with the abrasive dieting fibre in TGN and greater volume of digesta in the gastro-intestinal track which can impair nutrient absorption. This observation agrees with the findings of Susbilla *et al.* (1994) who reported that the proportion of carcass yield of broiler is influenced by the quality and availability of intrinsic nutrients of the feed.

Also, the differences ($P<0.05$) in the weight for thigh, drumstick and abdominal fat were

TABLE 3

Performance Characteristics of Broilers Fed Experimental Diets

Ingredient	*Level of replacement (%)*				*SE ±*
	0	*33.33*	*66.67*	*100*	
			Diet		
	1	*2*	*3*	*4*	
Initial body weight (g bird^{-1})	35.00	35.00	35.00	35.00	0.00
Final body weight (kg bird^{-1})	1.70	1.60	1.50	1.40	0.06
Average daily weight gain (g bird^{-1})	29.73^{a}	27.95^{ab}	26.16^{b}	24.38^{c}	1.15
Total feed consumed (kg bird^{-1})	5.39^{a}	5.22^{ab}	4.76^{bc}	4.57^{c}	0.19
Average daily feed intake (g bird^{-1})	96.25^{a}	93.21^{b}	85.00^{c}	81.60^{d}	3.43
Feed/gain ratio	3.24	3.33	3.25	3.35	0.03
Protein efficiency ratio	0.015	0.015	0.015	0.015	0.00
Mortality (%)	0.00	0.00	0.00	0.00	0.00

a-d: Means in the same row without a common superscript differ significantly ($P<0.05$)

TABLE 4

Carcass Characteristics of Broilers Fed Experimental Diets

Ingredient	*Level of replacement (%)*				*SE ±*
	0	*33.33*	*66.67*	*100*	
			Diet		
	1	*2*	*3*	*4*	
Final liveweight (kg bird^{-1})	1.70^{a}	1.60^{ab}	1.50^{bc}	1.40^{c}	0.06
Plucked weight (kg bird^{-1})	1.54^{a}	1.48^{ab}	1.34^{bc}	1.32^{c}	5.40
Eviscerated weight (kg bird^{-1})	1.36^{a}	1.32^{ab}	1.14^{bc}	1.12^{c}	6.20
Dressing percentage (%)	80.00	82.15^{ab}	76.00^{b}	70.00	1.26
Neck (g bird^{-1})	66.62	65.42	64.22	63.00	0.38
Wing (g bird^{-1})	87.30	87.18	87.62	86.24	0.44
Thigh (g bird^{-1})	145.78^{a}	115.44^{b}	109.39^{c}	95.37^{d}	10.63
Breast (g bird^{-1})	366.40	354.45	341.20	331.33	7.66
Drumstick (g bird^{-1})	94.35^{a}	85.50^{b}	76.48^{c}	68.50^{d}	5.59
Back (g bird^{-1})	243.98^{a}	235.58^{b}	223.16^{c}	180.50^{d}	14.10
Abdominal fat (g bird^{-1})	26.54^{d}	30.00^{c}	35.00^{b}	40.00^{a}	2.94

a-d: Means within the same row with the different superscript differ significantly ($P<0.05$)

significant. This agrees with the findings of Aina (1990) who reported significant differences in all cut parts and abdominal fat of cockerels.

The consistent increase in deposition of abdominal fat was due to higher percentage of ether extract in TGN (17.37 %) compared to that of maize (3.98 %), which increased ether extract progressively from Diet 1 to Diet 4.

Based on the results for broiler chickens fed TGN-based diets, inclusion of TGN at 66.67 and 100 per cent replacement levels for maize had adverse effect on the performance and carcass

characteristics assessed. Therefore, in absolute terms, TGN can be used up to 33.33 per cent (166.7 g kg^{-1} diet) in broiler diet without any deleterious effects on the birds, especially when the diet is supplemented with enzyme.

Furthermore, research is necessary on how to increase the nutritive value of TGN for monogastric animals like broilers, considering its relative cheapness and abundance.

Acknowledgement

The authors are grateful to the Managing Director, Bio-ingredient Nigeria Limited, Lagos, Nigeria, for supplying the enzymes; and to Mr O. A. Osofowora for typing the manuscript.

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