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Performance of Broiler Chicks (*Gallus domesticus*) Fed Maize Offal-Based Diets Supplemented with Roxazyme G Enzyme

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Abstract: An experiment was conducted to evaluate the performance of broiler chicks fed maize offal-based diets supplemented with roxazyme G enzyme. Seven experimental diets were formulated such that diet T_1 which served as the control, contained 0% maize offals and without enzyme supplementation. Diets T_2 and T_5 served as control for enzymes at increased levels of maize-offal supplementation. Diets T_3 and T_4 contained 20% maize offal supplemented with 100 mg and 200 mg of enzyme respectively, while diets T_6 and T_7 contained 40 % of maize offal supplemented with 100 mg and 200 mg of enzyme respectively. One hundred and forty seven (147) 4 week-old Anak broiler chicks were randomly assigned to the seven diets in a completely randomized design (CRD). Each treatment was replicated thrice with seven (7) birds per replicate. The experiment lasted for 28 day. Results showed that there were significant differences in the performance of the birds on the treatment groups in all the measurements recorded. Birds fed the control 1 diet had the highest weight gain and best feed conversion ratio, though this was not significantly higher than those fed diet T_3. There was no significant ($P > 0.05$) difference between the weight gain of the birds fed diets T_3 T_4 and T_7. There was a significant ($P < 0.05$) decrease in weight gain as dietary level of maize offal increased without enzyme supplementation. The feed intake of bird fed diet T_5 was significantly ($P < 0.05$) higher than those fed other treatment diets. The feed conversion ratio of birds fed T_1, T_3 and T_4 diets did not differ significantly ($P > 0.05$). Though there were significant ($P < 0.05$) differences on the feed conversion ratio of birds fed diets T_2, T_5 and T_6 , there was no significant ($P > 0.05$) difference on the feed conversion ratio of birds fed diets T_3, T_4 and T_7 . The result of the experiment showed that with Roxazyme G supplementation at either 100 mg or 200 mg/kg feed, maize offal can replace maize in the diets at up to 20 % level without any deleterious effect. However, at 40 % inclusion level, 200 mg/kg feed proved more effective. Economics of production showed that Roxazyme G supplementation were profitable as regards the cost of feed per kg weight gain and thus cost savings.

Key words: Performance, enzyme supplementation, maize offal, broiler chicks

Introduction

In Nigeria, maize has been widely used as the principal energy source in monogastric animal. However, the keen competition for this ingredient between man, industries and livestock has aggravated the cost of these ingredients beyond the reach of the average Nigerian livestock farmer. Thus feed contributes about 80% of the total cost of broiler production (Oruseibio and Smile, 2001). There is, therefore, the need to emphasis on the utilization of agro by-products that are considered useless for human consumption.

Maize offal is one of those agro by-products that may find place in poultry feeding. Unfortunately, cereal offal are known to be of high fibre content which are capable of reducing nutrient utilization and precipitate metabolic dysfunction when ingested by non-ruminant animals (Aletor, 1999). However, recent advances in biotechnology and animals nutrition have indicated that exogenous enzyme supplementation renders fibrous polysaccharides and other anti-nutritional factors utilizable by monogastric animals (Broz and Frigg, 1990).

Roxazyme G, an enzyme complex derived from *Trichoderma viride* with glucanase and xylanase activity is capable of hydrolyzing the polysaccharides in cereal offals into smaller molecules which the birds can digest and utilize (Broz and Frigg, 1990). The enzyme has been used to enhance the digestibility and utilization of cereal grains and their by-products. Therefore, the aim of this study was to evaluate the performance of broiler chicks to maize offal-based diets supplementation with Roxazyme G enzyme.

Materials and Methods

Experimental diets: Seven experimental diets were formulated such that diet T_1 which served as the control contained 0 %maize offal (maize- based), while diet T_2 contained 20% maize offal without enzyme supplementation. Diets T_3 and T_4 contained 20 % maize offal supplemented with 100 mg and 200 mg Roxazyme G per kilogram of feed respectively. Diet T_5 contained 40% maize offal without enzyme supplementation while

Table 1: Composition of experimental diets (%) diets

Ingredients	T_1	T_2	T_3	T_4	T_5	T_6	T_7	
	% maize offal replacement and Roxazyme G inclusion							
	0%	20%	20%+100E	20%+200E	40%	40%+100E	40%+200E	
Maize	60	48	48	48	36	36	36	
Maize Offal	0	12	12	12	24	24	24	
SBM	24	24	24	24	24	24	24	
Fish Meal	5.5	5.5	5.5	5.5	5.5	5.5	5.5	
Bone Meal	3	3	3	3	3	3	3	
PKC	5	5	5	5	5	5	5	
Blood Meal	2	2	2	2	2	2	2	
Salt	0.25	0.25	0.25	0.25	0.25	0.25	0.25	
Premix*	0.25	0.25	0.25	0.25	0.25	0.25	0.25	
Enzyme	-	-	0.1	0.2	-	0.1	0.2	
	100	100	100	100	100	100	100	
Calculated chemical composition of the diets and maize offal								
Nutrients								MO**
Crude	19.62	19.96	19.96	19.96	20.3	20.3	20.3	90.13
Protein	2.76	5.055	5.055	5.055	6.05	6.05	6.05	11.82
Crude Fibre	4.9	4.76	4.76	4.76	4.92	4.92	4.92	13.00
Ether Extract	3.14	3.44	3.44	3.44	3.74	3.74	3.74	13.42
Total Ash	61.3	59.71	59.71	59.71	59.5	59.5	59.5	5.4
NFE ME (Kcal/kg)	2982.8	2804.8	2804.8	2804.8	262.7	262.7	262.7	56.36

*The vitamin premix supplied the following per kilogram diet: - Vit.A (i.u) 4000,000; Vit.D (i.u) 1000,000; Vit.E (i.u) 4,800; Vit B. (g) 0.8; B_l (g) 0.4; Vit.B2 (g) 1.2; Nicotinic acid (g) 4.8; Folic acid (g) 0.12; Ascorbic acid (g) 20.0; Choline chloride (g) 120.0; Mn (g) 40.0; Fe (g) 20.0; Zn (g) 18.9; Cu (g) 0.80; Iodine(g) 0.62. ** Maize Offal

diets T_6 and T_7 contained 40 % maize offal with 100 mg and 200 mg Roxazyme /kg feed respectively (Table 1). Proximate composition of maize offal and the experimental diets were carried out using the procedure of AOAC (1990). This was conducted before the inclusion of the enzyme

Experimental animals and procedure: Day-old Anak broiler chicks procured from a commercial hatchery were used for the study. The chicks were electrically brooded for four (4) weeks during which time they were fed commercial enzyme-free broiler starter and watered *ad-libitum* in a deep litter system. At the end of the four (4) weeks brooding period a total of one hundred and forty seven (147) birds were randomly selected and divided into seven treatment groups of twenty one (21) birds each .Each group was randomly assigned to an experimental diet in a completely randomized design. Each group was further sub-divided into three replicate groups of seven (7) birds and kept in a compartment measuring 3 m x 3 m. The diets were labeled T_1 to T_7 to correspond with diets T_1 to T_7. Fresh water and corresponding diet were provided *ad libitum* throughout the experimental period. Prior to the commencement of the experiment, the birds were weighed to obtain their initial body weights. Vaccination and other routine poultry management practices which include daily inspection of the birds for symptoms of diseases, mortality, cleaning of troughs and supply of feed and fresh water were maintained. The experiment lasted for 28 days.

Economics of production: The market cost of the ingredients at the time of the study was used to calculate the total cost of the feed per kg diets (N), total cost of feed consume (N), cost of feed per kg weight (N) and cost saving (%).

Data collection and analysis: The daily feed requirement per replicate was weighed and served between 6.00 am and 7.00 am daily. The leftover feed per group was collected every morning, weighed and recorded. The daily feed intake of each replicate group was determined by difference.

Birds were weighed weekly. At the end of the experiment, the body weight changes were calculated by subtracting the initial body weight from the final body weight. The daily weight gain was determined by dividing the body weight change by the number of days the experiment lasted. The feed conversion and protein ratios of the birds were equally computed using the formula: average daily feed intake and average daily weight gain respectively average daily weight gain average daily protein intake.

Data collected was subjected to analysis of variance according to the method of Snedecor and Cochran (1979). The difference in treatment means was separated using Duncan's New Multiple Range Test as outlined by Obi (2002).

Results and Discussion

The calculated chemical composition of maize offal and the experimental diets are shown on Table 1. Data on the performance and economics of production of the broiler chicks fed on the experimental diets are shown in Table 2 and Table 3 respectively.

Table 2: Performance of broiler-chicks fed with Roxazyme G-supplemented maize offal diets

	T_1	T_2	T_3	T_4	T_5	T_6	T_7	SEM
Av. Initial body weight (g)	677	665	668	558	665	666	668	
Av. Final body weight (g)	1752.84^{a}	1429.34^{d}	1708.88^{a}	1589.0^{b}	1308.43^{e}	1594.48^{c}	1679.36^{b}	7.14
Av. Body weight gain (g)	1085.84^{a}	764.40^{d}	1040.88^{ab}	1031.0^{b}	643.43^{e}	928.48^{c}	1011.26^{b}	7.09
Av. Daily weight gain (g)	38.78^{a}	27.30^{d}	37.17^{ab}	36.82^{b}	22.98^{e}	33.16^{c}	36.12^{b}	1.34
Av. Total feed intake	4038.7^{b}	4171.2^{b}	4077.6^{b}	4073.9^{a}	4382.4^{b}	4154.0^{b}	4147.7^{b}	6.69
Av. Daily feed intake	144.24^{b}	148.07^{b}	145.63^{b}	145.48^{b}	156.51^{a}	148.36^{b}	148.13^{b}	1.26
Feed conversion ratio	3.72^{a}	5.46^{d}	3.92^{ab}	3.95^{ab}	6.81^{e}	4.48^{c}	4.10^{b}	0.33
Av. Daily protein intake	28.30^{c}	29.73^{b}	29.06^{b}	29.04^{b}	31.77^{a}	30.12^{b}	30.07^{b}	0.63
Protein efficiency ratio	1.37^{a}	0.92^{c}	1.25^{c}	1.24^{b}	0.72^{d}	1.09^{b}	1.20^{b}	0.26

^{a,b,c,d,e}Means with different superscripts on same row differ significantly (P 0.05)

Table 3: Economics of production of the broiler chicks fed on the experimental diets

	T_1	T_2	T_3	T_4	T_5	T_6	T_7
Feed cost /Kg (N)	31.51	27.23	27.43	27.63	24.95	25.15	25.35
Total feed cost (N)	125.81	113.58	111.85	112.56	109.34	104.47	105.14
Cost of daily feed intake(N)	4.49	4.06	3.99	4.02	3.91	3.73	3.76
Feed cost/kg gain (N)	115.87	148.59	107.46	109.18	162.17	112.51	103.97
Cost saving (%)		-	7.26	5.77	-	2.90	10.27

The crude protein values of the experimental diets seemed to increase with increase in the level of maize offal inclusion in the diets. Crude fibre values of the diets also increased progressively as dietary inclusion of maize offal increased. The energy values decreased with increase in the level of offal in the diets.

There were significant differences on the performance of the birds per treatment groups for all the measured parameters. Birds fed T_1 (control) and T_3 diets had the highest weight gain. The average weight gain of the chicks fed on 20 % maize offal supplemented with 100 mg Roxazyme G enzyme, compared favourably ($P > 0.05$) with those fed the control diet. There was no significant difference between the weight gain of the birds fed T_3, T_4, and T_7 diets. There was a significant decrease ($P < 0.05$) in the weight gain as dietary inclusion of maize offal increased without exogenous enzyme supplementation.

The marked decrease in weight gain with increase in the level of inclusion of maize offal in the diet without enzyme supplementation could be due to decreased digestibility and utilization of the diets emanating from the high fibre content. Ajala *et al.* (2003) had observed that high fibre contents of diets decreased nutrient utilization and precipitate metabolic dysfunction with the attendant weight reduction in monogastric animal. This could also be due to the fact that the birds mobilized body nutrients for maintenance of metabolism in the place of high dietary fibre. An (1994), had earlier reported that when birds are starved or when energy levels drops below body requirement, birds tend to mobilize body energy reserves for maintenance. However, supplementation of the diets with enzyme resulted in significant ($P < 0.05$) improvement in weight gain of the birds over the birds fed un-supplemented diets. The enhanced weight gain could be attributed to improved digestion and utilization of non starch polysaccharides in maize offal achieved by enzyme inclusion. Our report is in line with report of McNab and Smithand (1992), that roxazyme G complements the digestive enzymes of poultry to enhance the digestion and utilization of non starch polysaccharides in cereals and their by-products. Officer (2000) and Annison (1996) reported that exogenous enzymes worked in combination with endogenous enzymes to break up large molecules to sizes that can be utilized by the birds.

The feed intake of birds fed 40 % maize offal diet without enzyme supplementation was significantly ($P < 0.05$) higher than those on the other treatment diets. The significantly higher feed intake of birds fed 40% unsupplemented maize offal diet over the other groups is not surprising since feed intake in chickens is inversely related to dietary energy concentration. Maize offal is low in energy and as the level of inclusion increased, the fibre level of the diets also increased, and since birds eat to satisfy their energy requirement. The birds apparently increased their intake of the high fibre diets. Also dietary fibre has a laxative effect and therefore increased the rate of gastric evacuation in the birds. High rates of gastric evacuation is usually compensated for by increased feed intake (Aduku , 1993).

The non-significant difference in the feed intake of birds fed enzyme supplemented diets and those fed the control diet may have emanated from the break-down of the non-starch polysaccharides in the diet, leading to enhanced metabolizable energy value for enzyme supplemented diets. Oldalle and Hoffman (1996), in an earlier report observed that diets supplemented with enzymes had their metabolized energy increased by 10%.

The feed conversion ratio of birds fed diets T_1, T_3 and T_4 did not differ significantly ($P > 0.05$). Although there were significant ($P < 0.05$) differences on the feed conversion ratio of birds fed diets T_2, T_5, T_6 and T_7. Furthermore,

there was no significant ($P<0.05$) difference on the feed conversion ratio of birds fed diets T_3, T_4 and T_7. The feed conversion ratio recorded for birds fed enzyme supplemented maize offal-based diets indicated that the nutrients were more available, efficiently digested and utilized by the birds (Tuleun *et al.*, 2001, Broz and Frigg, 1990). However, at 40 % maize offal inclusion and 200 mg roxazyme supplementation proved more effective than 40% maize offal inclusion and 100mg roxazyme supplementation.

Table 3 showed the economics of bird production using the various diets. From the data, it is more profitable and economical to supplement maize offal diets with enzyme. The higher feed consumption of birds on unsupplemented maize offal diets increased the feed cost per kilogram weight gain and as such not recommended.

Conclusion: The use of maize offal to partially replace maize in broiler ration has shown that high level (40%) of inclusion increases feed intake, decreases growth rate and feed efficiency. With roxazyme G supplementation at either 100mg or 200 mg/kg feed, maize offal can replace maize in the diet at 20% inclusion without any deleterious effects on the performance of the birds. However, 200 mg/kg feed enzyme supplementation proved more effective even at higher (40 %) maize offal inclusion levels. Enzyme supplementation of the diets reduced the cost of production.

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