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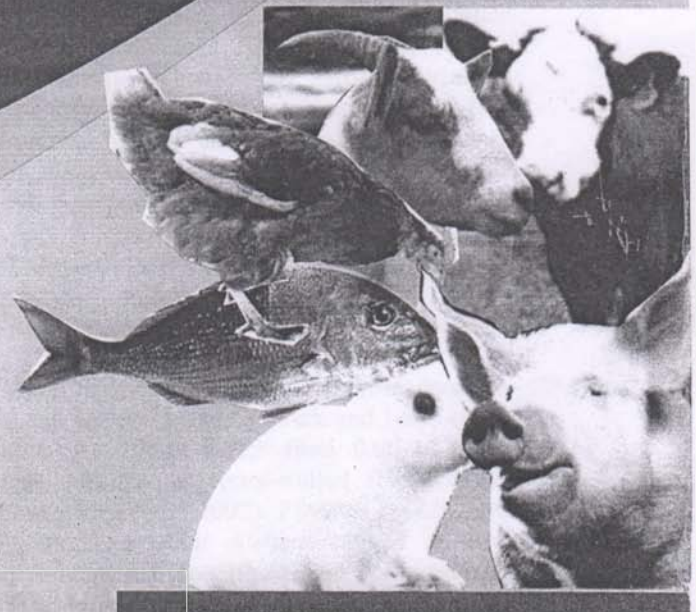

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ORIGINAL RESEARCH ARTICLE

Performance and carcass characteristics of broiler finishers fed diets supplemented with Roxazyme G and exogenous phytase

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ABSTRACT

A 21-day feeding trial involving 480, 4-week old unsexed Abhor Acre broilers was carried out in a completely randomised design to evaluate performance, carcass characteristics and cost benefit of broiler finishers fed iso-caloric and iso-nitrogenous corn-soyabean based enzyme supplemented diets. Diet 1 had no supplemented Roxazyme G and phytase (T1-basal diet). The other three diets are: T2-Roxazyme G (0.2g/kg), T3-basal diet +Phytase (1g/kg) and T4-basal diet +Roxazyme G and Phytase (0.2g/kg and 1g/kg) inclusion. The objective was to observe whether addition exogenous enzymes individually or as a mixture improved efficiency of broiler finisher production. The results showed no significant differences (p>0.05) across the dietary treatments for daily feed intake, weight gain and FCR. The values obtained were in the range of 137.9g, 1191.9g and 1.45 respectively. ***There were no significant difference (p>0.05) in carcass weight of birds on T4, T2 and T1 but birds fed both Roxazyme G and phytase had heaviest carcass weight of*** 1533.3g ***. However, birds fed diets supplemented with phytase alone had significantly lower carcass weight and dressing yield to other dietary treatments. The cut up parts were not significantly different (p>0.05) except the weights of the head, drumstick and breast meat. The cost analysis showed that it is not profitable to include the enzymes in the practical broiler finishers' diet used in this study. There was no need to include the above enzymes in the diet of broilers at finishing phase as the birds at this stage can efficiently utilize nutrients in their feed.***

Keywords: Broiler finisher, Phytase, Roxazyme G, Growth, carcass characteristics

INTRODUCTION

Broiler, a meat-type of poultry, has the ability to grow fast and reach market weight faster than ruminants (Madubuike and Ekenyem, 2001) and has stirred up interest in many farmers, because it plays a significant role as animal protein source in human diet. Cereal grains supply the bulk of livestock feed, especially for poultry and pigs. However, in developing countries like Nigeria, cereal grains are in high demand for human uses and the production is inadequate to meet the need of the increasing population, consequently, there is little or no excess grain for livestock feed and when available, it is always very expensive. Agro-industrial by-products (AIBs) are important feed components in poultry diets in Nigeria mainly due to the increased competition for the conventional ingredients by humans and the food industries (Iyayi and Davies, 2005). Those high fibre contents are being used either as fillers or as energy diluents or both. For example maize offal, rice offal (Tuleun *et al.*, 2009), brewer's dry grain (Iyayi and Davies, 2005) and palm kernel meal (Ezieshi and Olomu, 2004) have been employed in the formulation of poultry feeds. However, inclusion of high levels of some of the AIBs or the use of high-fibre containing ones in poultry diets is limited due to their effect of reduced performance in birds (Iyayi and Davies, 2005), reduced nutrient utilization and precipitate metabolic dysfunction with attendant growth depression when ingested by non-ruminants (Onyimonyi, 2005). To enhance the nutritive value of these agro-industrial by-products poultry farmers result to inclusion of feed additives which include antimicrobials, antioxidants, emulsifiers, binders, acidifers and enzymes. Phytic acid, *myo*-inositol hexaphosphate, is present in grains and oilseeds and is most known for chelating divalent cations (Deshpande and Cheryan, 1984). Since phytic acid and its salts (phytates) usually occur simultaneously in many seeds, researchers often refer to them as "phytates". Phytate in plant seeds is predominantly present as the calcium-magnesium-potassium salt called "phytin" (Swick and Ivey, 1992). The amount of phytate varies from 0.06-2.22% in cereals and 0.08-6% in cereal-milled fractions and protein products (Reddy, 2002). Phytates readily form insoluble complexes with divalent cations in weak acidic to neutral pH conditions and, consequently, reduces their bioavailability in animals. It also reacts directly or indirectly with charged groups of proteins,

amino acids, or form hydrogen bonds with starch, which may result in an adverse influence on protein and starch digestibility (Swick and Ivey, 1992; Maenz, 2001). Dietary phytase; an esterase that hydrolyzes phytic acid is of nutritional importance because the mineral binding strength decreases and the solubility increase, resulting in an increased bioavailability of essential dietary minerals (P and Ca), energy and amino acids (Cowieson *et al.*, 2006). Roxazyme G is an enzyme complex derived from *Trichoderma viride*. It has glucanase and xylanase activity which hydrolysis non starch polysaccharides into smaller molecules which can be utilized and digested by poultry (Broz and Frigg, 1990). This study was therefore carried out to determine the response of broiler finishers to diets supplemented with Roxazyme G and exogenous phytase.

MATERIALS AND METHODS

The experiment was carried out at the Poultry Unit, Teaching and Research Farm, University of Ibadan, Nigeria, between October and December. Roxazyme G and phytase used in the study were purchased from a commercial farm product store in Ibadan, Oyo state, Nigeria.

Experimental birds and diets

A total of 480 of 4-week old unsexed Abor Acre broilers of body weights between 779.58 - 783.33g were randomly allotted to four dietary treatments.

Each treatment was replicated 3 times with 40 birds per replicate. All necessary medications and vaccinations were carried out as recommended by the breeder. The birds were brooded for 3 weeks on a standard broiler starter feed and water was supplied *ad-libitum*. Diet 1 (control) was formulated to meet nutritional requirements of the birds at finisher phase without enzyme supplementation. Diet 2 contained Roxazyme G at 0.2g/kg; Diet 3 contained Phytase at 1g/kg while Diet 4 contained Roxazyme G and Phytase at 0.2g/kg and 1g/kg respectively. The gross composition of starter and finisher diets are shown in Table 1

Data collection

At the beginning of the experiment, the birds were weighed and subsequently weighed weekly. Feed intake was recorded daily; feed conversion ratio was calculated as quantity of feed consumed per unit weight gained over the same period. Mortality during the duration of the study was also recorded. At the end of the experiment, three birds per replicate whose weight were close to the mean weight of 1.9kg were slaughtered and carcass measurement was taken. Cost/kg of the diet, cost/kg weight gain of bird and cost of total feed consumed were also calculated.

Table 1: Gross composition of starter and finisher diets

Ingredients (%)	Starter	Finisher
Maize	54.13	55.00
Soyabean meal	30.00	21.00
Groundnut cake	5.00	10.00
Wheat offal	0.00	5.88
Fish meal	3.00	0.00
Palm oil	2.00	2.00
Oyster shell	2.00	3.00
Dicalcium phosphate	2.50	2.00
Premix*	0.25	0.25
L- lysine	0.10	0.20
DL-Methionine	0.20	0.20
Table salt	0.25	0.25
Mycofix	0.02	0.02
Biotronics	0.05	0.20
TOTAL	100	100
Calculated value		
Crude protein (%)	22.53	19.70
Energy (ME kcal/kg)	3010.4	3124.0
Crude fibre (%)	3.31	3.72
Calcium (%)	1.44	0.90
Available P. (%)	0.68	0.45
Methionine	0.55	0.49
Lysine	1.30	1.11

Premix provided the following per kg of diet vitamin A 12500 I.U. Vit D_3 2500 I.U. vit E 50 mg vit K_3 2.5mg; vit B_1 3.0mg; vit B_2 6.0mg; vit B_6 6.0mg; niacin 40.0mg; calcium pantothenote 10mg; Biotin 0.80mg; vit B_{12} 0.25mg; folic acid 1.0mg; choline chloride 300mg; manganese 100mg; iron 50mg; zinc 45mg; cobalt 0.25mg; iodine 1.55mg; selenium 0.1mg.*

Data analysis

All data collected were subjected to one-way Analysis of variance using SAS (version 9.2) package and means were separated using Duncan multiple range test of the same software.

RESULTS AND DISCUSSION

The results of performance characteristics of broiler finishers fed enzyme supplemented diets are presented in Table 2. There were no significant differences ($p>0.05$) among treatments in average daily weight gain (ADWG), average daily feed intake (ADFI) and feed conversion ratio (FCR). Birds fed on enzyme supplemented diets have been reported to have decreased feed intake as a result of fulfilling their nutrient requirement by taking less amount of feed (Samarasinghe *et al.*, 2000; Oladunjoye and Ojebiyi, 2010). However, the studies of Manafi *et al.* (2011)

Table 2: Performance characteristics of broiler finishers fed diets supplemented with Roxazyme G and Phytase (5 to 8 weeks)

Parameters	TI	T2	T3	T4	SEM(±)
Initial body weight (g)	782.5	783.3	779.6	781.3	2.54
Final body weight (g)	1974.4	1972.1	1888.7	1889.1	24.14
Average daily feed intake (g)	137.9	137.7	136.4	136.1	0.59
Average weight gain (g)	1191.9	1188.8	1109.2	1107.9	22.61
Average daily weight gain (g)	59.6	59.4	55.5	55.4	1.13
Feed conversion ratio	1.4	1.4	1.6	1.4	0.02
Mortality (%)	3.00	1.00	2.00	1.00	0.41

abc Means with same superscript are not significantly different (p> 0.05)
T1: Basal diet (without enzyme inclusion) T2: Basal diet with Roxazyme G inclusion at 0.2g/kg
T3: Basal diet with Phytase inclusion at 1g/kg T4: Basal diet with Roxazyme G and Phytase at 0.2g/kg and 1g/kg respectively

suggested that broiler finishers fed enzyme supplemented diets have increased feed intake due to increased nutrient digestibility. This however contradicted the findings of this study. This may be as a result of the age of the birds used in this study as broilers in the finishing phase utilise feed nutrient more efficiently (Iyayi and Adegboyega, 2004). The results of the carcass yield and cut up parts as influenced by enzyme supplementation is presented in Table 3. There were observed significant ($p<0.05$) differences in hot carcass weight and dressing percentage among dietary treatments. Carcass weight of birds on dietary T4 was significantly ($p<0.05$) different from birds on dietary T3.

However, the dressing yield (%) also showed significant ($p<0.05$) increase across dietary treatment with birds on T4 showing significant ($p<0.05$) difference from birds on other dietary treatment. Alam *et al.* (2003) and Rahman *et al.* (2005) had reported that enzyme addition in diet increases fat deposition in carcass and breast muscles and a resultant increase in carcass yield. However, the result of this study is contradicted by the findings of Biswas *et al.* (1999) and Nwoche *et al.* (2006). They reported that carcass yield did not differ among enzyme supplemented diets in broiler finishers. The cut up parts results of neck, shank, thigh, wings and back meat were not significantly ($p>0.05$) different across all dietary treatments. This showed that dietary enzymes inclusion at broiler finisher phase had no effect on tissue synthesis. These results support the findings of Ahmed *et al.* (2004) who reported that primal cut parts did not differ significantly ($p>0.05$) but were significant at $p<0.01$. This was also corroborated by the findings of Scheideler and Ferket (2000), Alam *et al.* (2003). Weights of the head, drumstick and breast meat though were significantly ($p<0.05$) different fell within the levels reported by Isikwenu *et al.* (2010). These values were highest in enzyme supplemented diets supported by the findings of Leeson *et al.* (1996), Ahmed *et al.* (2004), Rahman *et al.* (2005), except the drumstick weight which was highest in the control diet in contradiction to the findings of Scheideler and Ferket (2000), Alam *et al.* (2003). Scheideler and Ferket (2000) suggested that improvements in drumstick and thigh weights of enzyme supplemented diet was probably as a result of increase in bone ash and proposed improved tibial bone strength as muscle development was enhanced by improved mobility. However, no differences ($p>0.05$) was observed in breast meat weights of the same study. The breast muscles and drumsticks are the most economically important portion of the carcass and also provide the greatest portions of edible meat in broilers. Table 4 shows the gastrointestinal characteristics of broiler finishers as influenced by enzyme supplementation. There were no significant ($p>0.05$) differences in the intestinal length and weight across the dietary treatment. This supported the findings of Wang (2000), Iji *et al.* (2001), Awad *et al.* (2009). They concluded that this was due to reduction of the viscous environment in the intestinal lumen of birds caused by water-soluble NSP. The length of the ceca and weight of ceca and ileum also showed no significant ($p>0.05$) increase. The ileum weight is an indication of the rate of absorption of nutrient. This finding may be an indication that enzyme supplementation had no positive influence on the absorption of nutrients in broiler finishers used in this study. There were no significant ($p>0.05$) differences in the weight of the full and empty proventiculus.

Table 3: Cut up parts (% of live weight) of broiler finishers fed diets supplemented with Roxazyme G and phytase

Parameters	T1	T2	T3	T4	SEM(±)
Head	2.48[b]	2.87[ab]	2.59[ab]	3.17[a]	0.11
Neck	4.42	4.61	4.61	5.16	0.18
Shank	4.08	3.81	3.69	4.08	0.11
Drumsticks	11.52[a]	10.31[ab]	9.74[ab]	8.62[b]	0.33
Thigh	11.05	10.36	10.96	10.57	0.26
Wings	8.38	8.18	7.92	8.27	0.10
Breast	13.23[ab]	12.21[b]	12.62[b]	15.03[a]	0.40
Back	12.54	12.16	12.30	12.75	0.14
Carcass weight (g)	1426.67[ab]	1467.78[ab]	1395.56[b]	1533.33[a]	21.11
Dressing percentage (%)	76.89[b]	72.68[c]	71.96[c]	80.78[a]	0.83

[ab] Means with same superscript are not significantly different (p> 0.05)

Table 4: Gastrointestinal characteristics of broiler finishers fed diets supplemented with Roxazyme G and phytase

Parameters	T1	T2	T3	T4	SEM(±)
Full proventiculus (g)	8.71	9.64	8.75	9.59	0.24
Empty proventiculus (g)	8.09	8.86	8.29	8.98	0.21
Full crop (g)	13.02[a]	11.18[ab]	10.24[b]	9.60[b]	0.47
GIT weight (g)	102.96	108.19	91.30	96.79	3.35
Intestinal length (cm)	222.13	241.77	218.91	239.33	4.52
Weight of 2 cm ileum (g)	0.67	0.57	0.63	0.51	0.03
Ceca weight (g)	13.51	12.94	11.56	11.29	0.56
Ceca length (cm)	41.65	41.33	39.33	42.64	0.07

[ab] Means with same superscript are not significantly different (p> 0.05)
T1: Basal diet (without enzyme inclusion) T2: Basal diet with Roxazyme G inclusion at 0.2g/kg
T3: Basal diet with Phytase inclusion at 1g/kg T4: Basal diet with Roxazyme G and Phytase at 0.2g/kg and 1g/kg respectively

Table 5: Cost analyses of broiler finishers fed diets supplemented with Roxazyme G and phytase

Parameters	T1	T2	T3	T4
Cost/kg diet (₦)	88.3	90.8	89.3	91.8
Cost of feed/kg weight gain (₦)	204.3	210.4	219.58	225.5
Cost of total feed consumed (₦)	243.8	249.8	243.76	249.7

T1: Basal diet (without enzyme inclusion). T2: Basal diet with Roxazyme G inclusion at 0.2g/kg.
T3: Basal diet with Phytase inclusion at 1g/kg. T4: Basal diet with Roxazyme G and Phytase at 0.2g/kg and 1g/kg respectively

Wang (2000) concluded that an inclusion of enzyme preparation high in xylanase activity in a diet caused decreased weight of proventiculus. However, there was significant difference in weight of full crop. The value was highest in birds on control diet which probably indicates that enzyme inclusion in diet increases rate at which feed is digested in the GIT. The results of cost analysis are presented in Table 5. The result of this study shows that enzyme inclusion in an iso-caloric and iso-nitrogenous broiler finisher diet marginally increased the cost of feed/kg and consequently raises cost of production. Also the cost of feed/kg weight gain by bird also increased across the dietary treatments. This contradicted the result of Alam *et al.* (2003) and Rahman *et al.* (2005). They reported that enzyme inclusion in an iso-caloric and iso-nitrogenous broiler finisher diet reduced the feed cost/ kg weight gain thereby, increasing profit. This contradiction is probably because birds on control diet had the highest average weight gain in the course of the study. The cost of total feed consumed by bird also showed similar levels across dietary treatments. This may be explained by the average weight gain of birds on enzyme supplemented diets which is lower than the control diet. This supported the report of Alam *et al.* (2003) that concluded profitability may differ among enzymes signifying the importance of proper selection of enzyme to get best result.

CONCLUSION

The results obtained from this study indicated no significant increase in the performance, carcass yield, internal organ characteristics of broiler finishers fed diets supplemented with Roxazyme G and exogenous

Phytase. The cost analysis also indicated that it is not profitable to include enzymes in an iso-caloric and iso-nitrogenous broiler finishers' diet as this placed an additional cost on production. It is therefore concluded that, inclusion of enzymes in diet of broiler finishers on the same caloric and protein content of nutrient concentration did not improve performance, carcass yield and cost benefit.

CONFLICT OF INTEREST

Authors declare that there is no conflict of interest concerning this manuscript.

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