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Performance of starter broiler chickens fed diet supplemented with Smartchoice phytase enzyme

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Abstract

Phytase is essential for enhancing nutritional value of feed and improving animal growth performance and health. A study was conducted to evaluate the influence of Smartchoice phytase enzyme supplementation in the diet of starter broiler chickens. A total of 150 Ross strain broiler chicks were used for the study and allotted to five treatment groups of 30 birds each. Each group was further divided into three replicates of 10 birds per replicate. Five iso-nitrogenous (21.40% CP) and iso-caloric (2975.40 kcal/kg ME) dietary treatments were compounded to contain 0g/100kg (T_1), 10g/100kg (T_2), 15g/100kg (T_3), 20g/100kg (T_4) and 25g/100kg (T_5) of a commercial Smartchoice phytase enzyme preparation for 28 days in a Completely Randomized Design (CRD). Feed and water were provided to the chicks ad-libitum. Daily feed intake and weekly body weight were measured. The result showed that the daily feed intake and daily protein intake were not affected (P>0.05) by Smartchoice phytase enzyme supplementation. Final live weight, daily weight gain and total weight gain were significantly different among treatments. Protein efficiency ratio were significantly (P<0.05) higher in T_1 (2.10) than T_5 (1.80) but similar to T_2 (2.05), T_3 (2.05) and T_4 (1.96). Feed conversion ratio was significantly (P<0.05) different in T5 (2.58) and T_1 (2.02) but similar (P>0.05) in T_1 (2.02), T_2 (2.28), T_3 (2.31) and T_4 (2.38). Mortality was lowest in T5. Total feed cost per bird and daily feed cost per bird were not affected (P>0.05) by Smartchoice phytase enzyme supplementation while cost per kg of feed and daily feed cost per bird were not significantly (P>0.05) affected. The findings from this study showed that Smartchoice phytase enzyme could be supplemented up to 20g per 100kg in the diet of starter broiler chickens.

Keywords: Smartchoice phytase, nutritional value, protein efficiency, feed cost

Introduction

Phytase inclusion in animal feed results in a lower excretion of the phosphorous content in manure, contributing to a lower environmental impact of livestock farming. Results from several studies have shown increased phosphorus digestibility and utilization; hence reduced phosphorous excretion into the environment due to phytase addition to poultry diets (Bedford, 1995). The nutritional and economic value of corn soybean meal and other ingredients commonly used in poultry diets can be improved by the addition of appropriate preparation of phytase, carbohydrate, and other enzyme additives. Phytase and cellulose are important enzymes used in commercial poultry production. Phytase is anti-nutritional factors present in most plant materials that irreversibly chelates divalent cations and interferes with amino acid absorption in the gastrointestinal tract of birds, as well as other monogastrics (Wisema, 1992). Moreover, the faecal excretion of phylate phosphorous and chelated minerals is a major source of soil and water pollution when wastes are applied to farmland. Dietary phytase supplementation is used to improve utilization of phosphorous and other ionically active nutrients like amino acids and minerals, ultimately reducing mineral

emissions (Odetalla, 2000). Producers of poultry and other animals aim to provide high quality, homogenous products in a short time and at a minimal cost (Onunkwo, 2019). Therefore, any measure taken to reduce feed cost, improve efficiency of digestion and nutrient utilization, accelerate biochemical reactions and reduce cost of production especially for small scale farmers will be of immense benefit.

Materials and method

Location of study

The study was conducted at the Poultry Unit of the Teaching and Research Farm of the Michael Okpara University of Agriculture, Umudike, Abia State. Umudike is located on latitude 05^{0}C 28' North and 07^{0}C 32'East and lies at an altitude of 122 m above sea level. This area is situated within the tropical rainforest zone of West Africa which is characterized by long duration of rainfall (April - October) and short period of dry season (November-March). Average rainfall is 2169.8mm in 148 – 155 rain days. Average ambient temperature is 26^{0}C with a range 22^{0}C and 30^{0}C. Its relative humidity ranges from 50 to 90% (NRCRI, 2019).

Experimental diet, animals and management

Five Iso-caloric (2975.40 kcal/kg ME) and Iso-nitrogenous (21.40% crude protein) experimental diets supplemented with Smartchoice ®phytase enzyme at inclusion levels of 0g, 10g, 15g, 20g and 25g were formulated and compounded. The Smartchoice phytase enzyme was supplied by farm Associates Nig. Ltd. Enugu State. It was produced by Eggriculture Inc USA. The percentage compositions of the diets are presented in Table 1. A total of 150, one day old Ross strain broiler chicks were procured from a reputable hatchery. A week before the arrival of the chicks, the pens, feeders and drinkers were washed and disinfected with disinfectant. The chicks were weighed to get their initial live weight before introducing them into different treatments. The drinkers were cleaned twice daily (morning and evening) and other routine management practices were carried out.

Table 1 : Gross composition of starter broilers fed experimental diet supplemented with Smartchoice ®phytase enzyme

	Treatment (Enzyme inclusion)				
Ingredients	T1(0g/100kg)	T2(10g/100kg)	T3(15g/100kg)	T4(25g/100kg)	T5(25g/1kg)
Maize	55.00	55.00	55.00	55.00	55.00
Fishmeal	3.00	3.00	3.00	3.00	3.00
Soybean	32.00	32.00	32.00	32.00	32.00
Bone meal	2.00	2.00	2.00	2.00	2.00
Palm kernel cake	7.20	7.20	7.20	7.20	7.20
Lysine (%)	0.20	0.20	0.20	0.20	0.20
Methionine (%)	0.10	0.10	0.10	0.10	0.10
*vitamin premix (%)	0.25	0.25	0.25	0.25	0.25
Salt (%)	0.25	0.25	0.25	0.25	0.25
TOTAL	**100**	**100**	**100**	**100**	**100**
Crude protein	21.40	21.40	21.40	21.40	21.40
Me kcal/kg	2975.40	2975.40	2975.40	2975.40	2975.40

*Premix supplied package per kg starter diet; Vitamin A 15,000 IU, Vitamin D3, 13,000 I.U, Thiamine 2mg, Riboflavin 6mg, Pyridoxin 4mg, Cobalamine 0.05g, Biotin 0.08mg, Choline Chroride 0.05g, Maganise 0.096g, Zinc 0.06g, Iron 0.024g, Copper 0.06g, Iodine 0.014g, Selenium 0.024mg, Cobalt 0.024 and Antioxidant 0.125g
Enzyme name: Smartchoice ®Phytase Enzyme

Data collection and analysis

The initial weights of the broilers were determined at the start of the experiment after one week of brooding. The broilers were weighed weekly per replicate in order to ascertain their average weight gain. Feed intake was measured daily. This was determined as difference between feed consumed and feed refusal. Weighing of the birds was between 8:00am and 12:00 noon weekly with the removal of feed before weighing. Data collected was subjected to Analysis of variance (ANOVA) as described by Steel and Torrie (1980). The means were separated using Duncan's New Multiple Range Test (Duncan, 1955). Other parameters were evaluated from the following formulae:

Total weight gain = Final live weight (g/bird) – initial live weight (g/bird)

Average daily gain (g/bird) =

$$\frac{\text{Final live weight (g/bird)} - \text{initial live weight (g/bird)}}{\text{No of days the experiment lasted (21)}}$$

$$\text{Feed conversion ratio} = \frac{\text{Feed intake}}{\text{Weight gain}}$$

$$\text{Protein Intake} = \frac{\text{\% crude protein of diet X Quantity of feed consumed}}{100}$$

$$\text{Protein Efficiency Ratio} = \frac{\text{weight gain}}{\text{Protein intake}}$$

Total feed cost/bird = Total feed intake/bird X Cost/kg feed

$$\text{Daily feed cost/bird} = \frac{\text{Total feed cost/bird}}{\text{No of days the experiment lasted (21)}}$$

Cost/kg weight gain = FCR X cost/kg of feed

Results and discussion

The proximate compositions of the experimental diets are shown in Table 2. The dry matter (DM) contents of the diets ranges from 92.12% to 93.22%. Diet 2 with 10g/100kg of phytase enzyme had higher ether extract (EE) compared to the other diets. As the level of phytase supplementation increases, the crude fibre (CF) contents of the diet reduces. Supplementation with phytase also caused the crude protein (CP) content of the diets to drop from 23.54% in the control to 20.15% in diet 3. Diet 2 has the highest metabolizable energy (ME) of 368.93 calories/gramme while the least energy in the diet was obtained in the control. The ash contents of the diets reduced from 9.70% in diet 1 to 3.09% in diet 3 and increased in diet 4 and diet 5 respectively. The control diet had the least nitrogen free extract (NFE) while diet 3 had the highest value of NFE. The growth performance of starter broiler chickens fed diet supplemented with Smartchoice phytase enzyme at varying levels is presented in Table 3. The result shows that there was no significant ($P>0.05$) difference in the initial live weights, daily feed intake, total feed intake, and the daily protein intake of the chicks supplemented with the enzyme. The final live weight, daily weight gain, total weight gain and the protein efficiency ratio (PER) were significantly ($P<0.05$) higher in T_1 than in T_5 but similar ($P>0.05$) to T_2, T_3 and T_5. The feed conversion ratio (FCR) also showed significant difference between T_5 and T_1. T_5 had the highest value for FCR while T_1 had the lowest but similar value of FCR to T_2, T_3 and T_4, Mortality was significantly ($P<0.05$) higher in T_3 and T_4 than in T_1 and T_2. T_5 recorded 0% mortality. This result indicates that the supplementation of broiler starter chickens with phytase enzyme above 20g /100kg of feed produced a corresponding decrease in the performance of the starter broiler chickens. Saima *et al.* (2009) reported improved feed intake, total weight gain and better FCR in low phosphorous diets supplemented with phytase enzyme up to 750 IU/kg of feed compared to a diet without supplementation. Similar report was also given by Cabahug *et al,* (1999) and Shirley and Edwards (2003). The findings from this study may be due to the fact that the bioavailability of phosphorous in the control diet is sufficient in meeting the

phosphorous needs of starter broiler chickens; hence little or no need for supplementation. Supplementary phytase would have produced a better result if the level of phosphorous in the starter broiler chicken diets were reduced below the optimal requirements. Bone meal as an animal source of phosphorous used in the formulation of the diets is considered to contain 100% bioavailability in phosphorous (Olomu, 1995).

Table 2: Proximate composition of experimental diets (% dry matter)

Parameters (%)	T1	T2	T3	T4	T5
Dry matter	92.62	93.22	92.12	92.71	92.67
Crude protein	23.54	20.46	20.15	20.44	20.63
Crude fibre	5.82	5.74	4.06	4.10	3.82
Nitrogen free extract	49.19	53.78	59.95	55.83	52.29
Ether extract	4.37	9.84	4.87	4.93	4.93
Ash	9.70	3.40	3.09	7.41	11.00

Table 3: Growth performance characteristics of broiler chickens fed diet supplemented smartchoice phytase enzyme

Parameters	**T1**	**T2**	**T3**	**T4**	**T5**	**SEM**
IBW (g/b)	50.73	50.50	50.57	50.87	50.55	0.05
AFI (g/b)	1757.00	1753.92	1763.16	1723.96	1718.36	1.30
ADFI (g/b/d)	62.75	62.64	62.97	61.57	61.37	0.62
FBW (g/b)	726.00^{a}	700.33^{ab}	699.00^{ab}	671.00^{ab}	627.67^{b}	12.30
AWG(g/b)	675.27^{a}	649.50^{ab}	648.43^{ab}	620.13^{ab}	577.12^{b}	8.25
ADWG (g/b/d)	24.11^{a}	23.19^{ab}	23.15^{ab}	22.14^{ab}	20.61^{b}	0.30
FCR	2.60^{b}	2.70^{ab}	2.72^{ab}	2.78^{ab}	2.98^{a}	0.50
Mortality	2.28^{b}	2.28^{b}	5.56^{a}	5.56^{a}	0.00^{c}	0.09

a-b-c Means with different super scripts in the same row are significant different (pε0.05), S.E.M: Standard Error of mean. IBW=Initial Body Weight, FBW=Final Body Weight, AWG=Average Weight Gain, ADWG=Average Daily Weight Gain, AFI=Average Feed Intake, ADFI=Average Daily Feed Intake, FCR=Feed Conversion Ratio.

The feed cost benefit of starter broiler chickens fed diet supplemented with Smartchoice phytase enzymes is shown in Table 4. The total feed intake, total feed cost per bird and daily feed cost per bird were statistically similar (P>0.05) among the treatment means. Cost/kg of feed and cost/kg weight gain varied statistically (P<0.05) among the treatments. T_5 was statistically (P<0.05) higher than T_1 and T_2 but similar (P>0.05) to T_3 and T_4 in terms of cost/kg of feed and cost/kg weight gain. Increase in the level of phytase supplementation produced a corresponding increase in cost of feed and cost of weight gain. Saima *et al* (2009) reported a corresponding statistically similar (P>0.05) increase in the cost of feed as the level of supplementation of phytase enzyme increases. However, this transcends to a reduced cost/kg of live weight.

Table 4: Feed cost benefit of starter broilers fed diet supplemented with Smartchoice phytase enzyme

Parameters	**T1**	**T2**	**T3**	**T4**	**T4**	**SEM**
Cost/kg feed (N)	98.74^{b}	99.34^{b}	99.64^{ab}	99.94^{ab}	100.24^{a}	0.14
Cost of feed consumed/B (N)	129.08	129.44	130.53	128.85	128.41	1.26
Cost/kg weight gain (N)	215.31^{b}	224.27^{b}	228.18^{ab}	235.34^{ab}	256.02^{a}	5.10

^{abc} Means on the same row with different superscripts are significantly (p<0.05) different.
SEM = Standard error of mean

Conclusion

The result of this study has indicated that the Smartchoice phytase enzyme could be supplemented up to 20g/100kg in the diet of starter broiler chickens. However, since there were no significant differences in terms of the parameters evaluated when compared to the control diet, it becomes reasonable to re-evaluate the phosphorous level in the diets so that at the lower phosphorous level, the enzyme supplementation at higher inclusion level would produce better results.

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