BAP -04

Effect of Phytase Supplementation on the Performance of Broilers Fed Rice Bran-Based Diets

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Abstract
The effect of phytase supplementation on the performance, dry matter intake(DMI) and total tract DM(TTDM) of broilers fed rice bran (RB)-based dietswere investigated. A total of 216, one-day-old Arbor Acrebroiler chickens (BC) were offered broiler starterdiettill day 20. The birds were fed experimental diets from day 21-28 after which feed consumption and body weight (BW) of the BC were recorded. On days 23, 24, 25 and 26 fresh excreta samples were collected at 24-hourly intervals and dried. The experiment had six replicates with six birds per replicate. Six semi-purified diets with 150, 300 and 450g/kgRB and 0 or 1000units of phytase (Natuphos) were formulated in a 3x2 factorial arrangement. Data were analysed using the general linear model of SAS. Orthogonal polynomial contrast was used to determine phytase and their interaction with RB with $\alpha_{0.05}$ as significant. Phytase supplementation improved the performance of the birds ($p<0.05$) and the inclusion levels of RB significantly ($p<0.05$) increased DMI. Rice bran and its interaction with phytase had no significant ($p>0.05$) effect on growth performance, DMI, and TTDM. Phytase increased ($p<0.05$) BW gain and DMI. Feed conversion ratio (FCR) significantly improved at the inclusion rate of 150g/kg RB. Results suggest that supplementation of RB-based diets with microbial phytase improved growth performance and DMI in broiler chickens.

Keywords: Rice bran, phytase, dry matter intake, total tract and broiler

Introduction

Phytic acid (PA) or inositol hexaphosphate is a molecule composed of highly ionizable phosphate groups that are present in vegetable ingredients. Due to lack of specificity of this molecule, a variety of phytic acid salts can be found in nature (Munaro *et al.,* 1996). These phytate salts are considered as anti-nutritional factors because they form insoluble complexes in the intestine and reduce the availability of cations,carbohydrates (Ravindran *et al.,* 1999). Due to limited intestinal phytase in BC, poultry diets are supplemented with inorganic P sources resulting in large amounts of P in the diets which subsequently pass into the environment through their excreta.

The commercial use of phytase has helped to ameliorate the challenges of eutrophicaton and also increasing the amount of intestinal phytase in the digestive tract of broiler chickens (Mutucumarana and Ravindran, 2016). The efficacy of phytase in improving birds performance and DMI in non-ruminant animals has been reported (Akinmusire and Adeola, 2009). Yi *et al.* (1996) reported that broilersachieved 11 to 22% increase in BWG when diets were supplemented with phytase. Mohammed *et al.* (2010) also reported that supplementation of rice bran diets with phytase significantly improved hen-day production and FCR. Due to the high cost of conventional plant feedstuff for poultry production in developing countries, poultry farmers use novel energy sources as alternatives. RB is one of such energy sources with a potential for feeding poultry. The performance, DMI and TTDM content of RB has not been reported for broiler chickens.

The effect of phytase supplementation on the performance, dry matter intake and total tract DM of broilers fed rice bran-based diets was investigated in this study.

Materials and Methods

A total of 216, one-day-old Arbor Acre broiler chicks were fed a starter diet till day 20. Vaccination and other routine management practices were carried out. On day 21, the chicks were individually weighed and distributed into 36 cages in a randomizedcomplete block design with 6 replicate cages per treatment (6) and 6 birds per cage. Six semi-purified diets of 3 levels of Total P without and with phytase (1000FTU/kg, Natuphos, BASF Germany) respectively, obtained by the gradual replacement of cassava starch with rice husk was formulated.

Addition of titanium dioxide as an indigestible marker at the rate of 5g/kg of diet was carried out. The chicks were offered the diets *ad libitum* and clean water made available. On days 23, 24 and 25 fresh excreta samples were collected from trays placed beneath each cage at 24-hourly intervals and dried at 55^{o}C using a force draught oven. Feed intake was calculated as the difference in the amount offered and refused, on cage basis. The study lasted 28days.

Table 1: Gross composition of experimental diets (g/kg) (as-fed basis)

Ingredients	0 FTU/Kg (without Phytase)			1000FTU/Kg(with Phytase		
	Diet 1	Diet 2	Diet 3	Diet 4	Diet 5	Diet 6
Rice Bran	150.00	300.00	450.00	150.00	300.00	450.00
Cassava Starch	464.50	316.25	168.00	454.50	306.25	158.00
Wheat gluten	220.00	220.00	220.00	220.00	220.00	220.00
Soya oil	20.00	16.25	12.50	20.00	16.25	12.50
Dextrose	102.25	102.25	102.25	102.25	102.25	102.25
Methionine	1.00	1.00	1.00	1.00	1.00	1.00
Lysine	1.00	1.00	1.00	1.00	1.00	1.00
Limestone	11.25	13.25	15.25	11.25	13.25	15.25
Limestone	11.25	13.25	15.25	11.25	13.25	15.25
Salt	2.50	2.50	2.50	2.50	2.50	2.50
Phytase Enzyme	0.00	0.00	0.00	10.00	10.00	10.00
Titanium dioxide	25.00	25.00	25.00	25.00	25.00	25.00
Premix						
Total	1000.00	1000.00	1000.00	1000.00	1000.00	1000.00
Calculated Nutrients						
ME (Kcal/Kg)	3530.00	3427.17	3324.34	3495.10	3392.27	3289.44
CP (g/kg)	211.19	230.54	249.89	211.19	230.54	249.89
Ca (g/kg)	5.72	6.59	7.45	5.72	6.59	7.45
Total P (g/Kg)	4.45	6.70	8.95	4.45	6.70	8.95
Ca : P ratio	1.29	0.98	0.83	1.29	0.98	0.83

FTU-Phytase unit, ME-Metabolizable energy, Ca-calcium, CP-Crude Protein, P-Phosphorus

Results andDiscussion

There was no significant ($p>0.05$) difference in the Interaction of RB with phytase for the performance parameters (Table 2). But phytase significantly increased($p<0.05$) BWgain of birds fed 150g/kg RB when compared to the same level for the unsupplemented diets. No observable difference ($p>0.05$) was seen for feed intake at the different levels of RB inclusion irrespective of phytase supplementation. FCRimproved ($p<0.05$) for birds fed 150g/kgRB for diets supplemented with phytase.Phytase and its interaction with RB did not show any observable difference for performance, DMI and TTDM.

Table 2:Performance of birds fed rice husk-based diets without or with phytase supplementation

Parameters	Phytase, 0FTU/kg			Phytase, 1000FTU/kg				P ANOVA		
	RB Diet 1	RB Diet 2	RB Diet 3	RB Diet 4	RB Diet 5	RB Diet 6	Pooled SEM	Phytase (Phy)	RB	PhyX RB
BWG	55.3^{a}	41.0^{ac}	48.3^{ab}	57.7^{b}	51.3^{bc}	57.7^{b}	2.2	0.0006	0.25	0.29
FI	126.7^{ab}	138.3^{abc}	150.7^{ac}	113.3^{b}	156.7^{ac}	161.67^{c}	5.11	0.56	0.008	0.35
FCR	3.75^{a}	3.47^{a}	3.21^{a}	2.11^{b}	3.08^{a}	2.91^{ab}	0.15	0.01	0.55	0.09

^{abc}Means in a row with different superscripts are significantly different from each other ($p<0.05$); FI – Feed intake; FCR- Feed conversion ratio

Table 3 shows that the level of RB inclusion in the diet increased DMI significantly ($p<0.01$) irrespective of supplemental phytase, while phytase and its interaction with RB did not show any observable ($p>0.05$) difference. Total tract DM was not significant ($p>0.05$) for the supplemented and unsupplemented diet. Phytase, level of RB and its interaction with phtyasefor total tract minerals (TTM) or ash had significant ($p<0.05$) effect. There was significant reduction of TTM of birds fed 300g/kg and 450gkgRB for phytase supplemented diets.

Table 2 shows the results of BWG, FI and FCR of broilers fed RB-based diets from day 21 to 28. Birds fed 150 g/kgRB had a significant increase in BW gain for the phytase supplemented diets. The improved growth performance can be attributed to the increased intake of nutrients (Miles and Nelson, 1974).Improved feed conversion ratio (FCR), can also be due to increased

release of P from the phytate-mineral complex as reported by Iyayi (2013). It could also have been due to increased utilization of inositol (Iyayi, 2013) or overall nutrient utilization. The results of improved DMI and total tract minerals support these earlier reports of the efficacy of the phytase used in improving the growth performance of the birds. The inclusion of RB to poultry diets has shown a significant effect on broiler chicks. Similar results have been reported by Jang *et al.* (2003) for improved total tract phytate digestibility for barley and corn.

Table 3:Dry matter intake, excreta dry matter and excreta ash of birds fed rice husk-based diets without or with phytase supplementation

Parameters	Phytase, 0FTU/kg			Phytase, 1000FTU/kg				P ANOVA		
	RB Diet 1	RB Diet 2	RB Diet 3	RB Diet 4	RB Diet 5	RB Diet 6	Pooled SEM	Phytase (Phy)	RB	Phy X RB
DMI	121.5^{ad}	145.1^{a}	142.7^{b}	109.7^{c}	152.3^{d}	149.4^{d}	4.82	0.93	0.006	0.61
EDM	0.84	0.85	0.83	0.99	0.98	0.99	0.03	0.004	0.99	0.98
EA	28.5^{ab}	31.5^{a}	21.41^{a}	37.83^{b}	25.8^{a}	26.3^{a}	1.02	0.023	<0.01	<0.01

^{abc}Means in a row with different superscripts are significantly different from each other (P<0.05); EDM – Excreta dry matter; EA – Excreta ash.

In this study, the phytate-P (1000FTU/kg) accounted for the significant effect on DMI. Excreta DM showed no observable effect irrespective of phytase supplementation. Phytasesupplementation have also been reported to improve Ca and P retention in broiler chickens (Viveros *et al.,* 2002) and in pigs with a reduction in excreted P by 21.5% in the animal (Harper *et al.,* 1997). These reports support results in this study of excreta ash(minerals) with a reduction of TTM. There is limited published dataon the mineral composition of excreta obtained from broilers fed different cereal-based diets.

Conclusion and Recommendation

It can be concluded that supplementation of RB up to 150g/kg with 1000 units of phytase improved growth performance and DMI. Farmers are encouraged to formulate broiler diets with RB(150 g/kg) supplemented with phytase to achieve optimum absorption of appropriate nutrients and to reduce pollution of the environment with phosphorus.

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