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Effect of phytase supplementation on growth performance of growing pigs fed on rice polish based diets

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In the eastern region of India, rice milling by-products the major animal feedstuffs (3.84 million tonnes) contribute about 62% of total available energy feeds for livestock (Ramachandra *et al*. 2007). Rice polish is good source of several nutrients including phosphorus (P). However, most of P in rice polish is in the form of phytate which is unavailable to non-ruminants due to lack of endogenous phytase enzyme. Studies indicated that inclusion of phytase enzyme in pig diets based on corn, wheat or barley with soy increases availability of P (Thacker *et al*. 2006) and improves nutrient digestibility in growing pigs ((Kies *et al*. 2006). Hence, present work was undertaken to study the efficacy of phytase enzyme supplementation at different levels in rice polish based diets on the nutrient digestibility and performance of crossbred growing pigs.

Weaned castrated male crossbred (Hampshire x Khasi Local) pigs having 75% exotic inheritance were used in 2 feeding experiments conducted. First experiment (Exp. 1) was conducted to study influence of phytase enzyme supplementation in 50% rice polish based diet on the performance in pigs (20; 9.02±0.05kg BW) for the duration of 90 d. Five iso-nitrogenous (16% CP) and isocaloric (3000 kcal DE/kg) diets were prepared with uniform level of

Table 1. Main ingredient and calculated nutrient composition of diets for different treatments during experiments 1 and 2

Particulars	Dietary treatments under different experiments							
	Exp. 1					Exp. 2		
	T1	T2	T3	T4	T5	T1	T2	T3
Ingredient composition (kg/100kg)								
Rice polish	50.00	50.00	50.00	50.00	50.00	50.00	70.00	70.00
Maize	30.40	30.00	30.39	30.38	30.36	30.00	14.00	14.00
GNC	6.00	6.00	6.00	6.00	6.00	6.00	-	-
Soymeal	11.00	11.00	11.00	11.00	11.00	11.00	10.00	10.00
Fish meal	-	-	-	-	-	-	4.00	4.00
Lime	1.50	0.50	1.50	1.50	1.50	1.50	0.90	0.90
DCP	-	1.40	-	-	-	-	-	-
Common salt	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Supplevite-M	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Phytase	-	-	0.01	0.02	0.04	0.02	0.02	0.04
Calculated nutrients composition (% DM basis)								
DM	90.00	91.30	90.80	90.00	89.19	90.24	91.14	89.29
CP	16.17	16.16	16.19	16.26	16.16	17.34	17.26	17.32
EE	6.67	6.64	6.54	6.77	6.52	6.96	8.57	8.55
CF	5.28	5.36	5.42	5.45	5.31	6.54	8.32	8.31
TA	9.01	8.75	8.75	8.60	8.59	7.58	8.79	8.94
Ca	0.61	0.60	0.61	0.61	0.61	0.61	0.58	0.58
Total P	0.99	1.21	0.95	0.96	0.98	0.78	1.06	1.08
Available P	0.13	0.34	0.13	0.13	0.13	0.13	0.23	0.23
Feed cost (Rs/kg)	11.64	12.18	11.66	11.68	11.72	12.44	11.65	11.69

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Table 2. Performance of pigs fed with different diets during experiment 1

Particulars	Treatments mean ± SE					SEM±
	T1	T2	T3	T4	T5	
Growth performance						
Initial body weight (kg)	8.87±0.55	9.12±0.55	9.00±0.73	9.00±0.41	9.12±0.74	0.61
ADG (g/d)**	387^{a}±7.80	429^{ab}±4.00	410^{a}±13.95	453^{b}±8.02	429^{ab}±13.43	10.16
Av. feed intake (g/d)	1305	1305	1305	1305	1305	-
FCR**	3.37^{b}±0.07	3.04^{a}±0.03	3.19^{ab}±0.11	2.88^{a}±0.05	3.04^{a}±0.09	0.08
Feed cost/kg gain (Rs)**	39.22^{b}±0.82	37.02^{ab}±0.36	37.25^{ab}±1.27	33.70^{a}±0.60	35.72^{ab}±1.08	0.89
Nutrient digestibility						
DM* (%)	72.81^{a}±1.22	74.68^{ab}±0.22	73.64^{a}±0.51	76.51^{b}±0.48	73.46^{a}±0.38	0.66
CP *(%)	69.59^{a}±0.24	71.89^{b}±0.08	71.19^{a}±0.82	73.12^{b}±1.20	71.66^{b}±0.39	0.68
P** (%)	37.61^{a}±0.86	52.06^{c}±0.58	45.81^{b}±0.30	52.25^{c}±0.47	52.34^{c}±0.59	0.59

Different superscripts in a row differ significantly (P<0.01)** / (P<0.05)*

calcium (0.6%). The control diet possessed 0.13% available dietary P (T1), and dicalcium phosphate (DCP) was added to maintain the recommended level of available P at 0.34% (T2). Other diets possessed 0.13% available P and these were supplemented with granular and thermostable phytase enzyme with minimum activity of 5,000 FTU/g at 10 (T3), 20 (T4) and 40 (T5) g/100kg feed which correspondingly provided 0.5, 1.0 and 2.0 lac FTU of phytase enzyme per 100 kg feed in respective diets. The main ingredients and calculated composition of the diets under different treatments are shown in Table 1.

Another experiment (Exp. 2) was conducted in 12 weaned pigs (12; 9.73±0.44kg BW) in completely randomized design for 118 d duration. Based on the performance from the Exp. 1, the control diet having 0.13% available P was formulated with 50% rice polish and 20g phytase/100 kg (T1), while other diets having 0.23% available P formulated with 70% rice polish and 20g (T2) or 40g (T3) phytase/100kg. The respective diets were isonitrogenous (17% CP) with phytase at levels of 1.0, 1.0 and 2.0 lac FTU/100kg feed (Table 1).Pigs in both experiments were housed in well ventilated cemented floor pens individually. Every animal had free access to clean drinking water in individual pen and given weighed quantities of feed daily as per requirements (ICAR 1985). At the end of feeding for particular duration in respective experiments, digestion trials of 6 d duration were conducted. The samples of feed, feces and residues were collected as per standard procedures and pooled samples were chemically analyzed according to AOAC (1980). The data were statistically analyzed as per Snedecor and Cochran (1980).

The initial body weights and average daily feed consumption remained similar across treatments. The ADG was improved by 11% on addition of DCP. With addition of phytase at 0.5,1.0 and 2.0 lac FTU/100 kg diet without increasing the total dietary P in corresponding treatments of T3,T4 and T5; the ADG improved by 6,17 and 11% respectively over the control. Narrowest FCR (feed conversion ratio) and feed cost per kg gain were observed in diet supplemented with phytase (FTU/100kg) at 1.0 lac

Table 3. Performance of pigs fed with different diets during experiment 2

Particulars	Treatments mean ± SE			SEM±
	T1	T2	T3	
Growth performance				
Initial body weight (kg)	9.94 ±0.82	10.37 ±1.25	8.88 ±0.82	0.97
ADG (g/d)*	452^{a} ±13.63	394^{a} ±11.28	423^{ab} ±6.80	10.94
Av. feed intake (g/d)	1337	1314	1314	-
FCR*	2.97^{a} ±0.09	3.34^{b} ±0.10	3.11^{ab} ±0.05	0.08
Feed cost/kg gain (₹)	36.91 ±1.12	38.97 ±1.14	36.36 ±0.60	0.98
Nutrient digestibility				
DM* (%)	76.84^{b} ±0.38	72.93^{a} ±1.15	73.91^{a} ±0.40	0.74
CP **(%)	77.89^{b} ±0.19	69.99^{a} ±1.30	71.37^{a} ±0.26	0.77
P** (%)	54.01^{ab} ±0.62	51.53^{a} ±0.83	55.25^{b} ±0.38	0.64

Different superscripts in a row differ significantly (P<0.01)** / (P<0.05)*

FTU phytase/100kg. Results demonstrated improvement in the growth performance in pigs either with increase of dietary total P or with addition of phytase. Almost similar trend was also observed in the digestibility of DM, CP and P where, significantly (P<0.01) highest digestibility was observed on feeding the diet which contained 50% rice polish with 1.0 lac FTU/100kg phytase (Table 2). Yin *et al*. (2010) also reported that microbial phytase can hydrolyze phytate complexes and thereby improves the nutrient digestion and absorption. Moreover use of phytase at highest level (2.0 lac FTU/100kg diet) did not excel over a level of 1.0 lac in the diets containing 50% rice polish.

In second experiment (Table 3), the average feed intake was similar in all dietary treatments. The ADG was significantly (P<0.05) higher on the phytase supplementation at 1.0 lac FTU/100kg diet containing 50%

rice polish (T1) than diet containing 70% rice polish with similar level of phytase supplementation in T2. Further, phytase supplementation at 2.0 lac FTU/100kg in the diet containing 70% rice polish (T3) produced higher (non-significant) ADG thanT2, but lower than T1. The FCR was narrowest on the diet having 50% rice polish with phytase at 1.0 lac FTU/100kg. The cost of per unit BWG was lowest in T1 followed by T3 and T2. The per cent digestibilities of DM and CP were significantly ($P<0.05$) higher in T1 followed by T3 and T2. The P digestibility was 54% in T1; it depressed on increase of level of dietary rice polish (51.5%, in T2). Further improvement was observed on increase in the level of phytase supplementation (55.3%, T3).

SUMMARY

Significantly highest ADG, FCR and digestibility of DM, CP and P were observed on diets containing rice polish 50% and phytase enzyme 1 lac unit. DM and CP digestibility decreased significantly in pigs fed on diets having 70% rice polish irrespective of level of supplementation with phytase. Thus, it is concluded that phytase supplementation at 1.0 lac FTU/100kg diet containing 50% rice polish improves the growth performance and nutrient digestibility and phytase supplementation at 2.0 lac FTU/100kg diet containing 70% rice polish may also be used for better growth performance (daily growth rate, FCR and feed cost per kg body weight gain) in grower crossbred pigs.

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