NM 16. STUDY ON THE EFFECT OF INORGANIC PHOSPHORUS SOURCES AND PHYTASE SUPPLEMENTATION IN WEANING-GROWING BARROWS

In K. Han, H. L. Choi and K. Kwon

Department of Animal Science & Technology, College of Agriculture & Life Sciences, Seoul National University, Suweon 441-744, Korea

Resumen

Estudio sobre el efecto de las fuentes inorgánicas de fósforo y la suplementación con fitasa en el destete-crecimiento de cerdos

Un total de 160 cerdos (9.9 kg. p.v.) fueron agrupados en 5 tratamientos: Control (100 % NRC Ca, P con TCP), TCF (70 % NRC Ca, P con TCP), TCPP (TCP + 500 FTU Fitasa), MCP (70 % NRC Ca P con MCP) y MCPP (MCP + 500 FTU Fitasa). MCPP mejoró significativamente la ganancia de peso ($P < .05$), MCP fue superior mejorando la ganancia de peso y la conversión de alimento que TCP ($P < .05$), y la adición de Fitasa fue altamente significativa en mejorar la ganancia de peso y la conversión alimenticia ($P < .01$). La adición de Fitasa mejoró no sólo la digestibilidad del fósforo pero también la digestibilidad de la M.S. y de la P.C.. La excreción de M.S. fue substancialmente reducida con la adición de Fitasa ($P < .05$). La excresión de N y P mostró la misma tendencia que la excreción de M.S. ($P < .05$). Cuando la cantidad excretada fue convertida a la excreción por 100 kg de ganancia de peso, los cerdos alimentados con la dieta TCPP excretaron 24.2 % menos fósforo que el Control, y MCPP excretó 47.5 % menos fósforo que el Control. Se encontró que MCP fue una fuente de P inorgánico más eficiente que el TCP. Con la fuente adecuada de P inorgánico y Fitasa el contenido de P de las dietas de cerdos en destete-crecimiento podrían reducirse en un 30 %.
Palabras claves: Fitasa, cerdos, MCP, TCP, crecimiento, excreción de nutrientes.
Key words: Pliytase, pigs, MCP, TCP, growth, nutrients excretion.

Introduction

P is not only an essential nutrient for animals but also a major pollutant to ground water. Recently, many researchers have studied the effect of phytase to reduce P excretion from animals and reported a lot of promising results. There is some evidence that the availability of various inorganic P sources are different. (SCA, 1987, Church, 1991). Thus this study was conducted to investigate the possibility to further reduce P excretion with the use of proper inorganic phosphorus source and phytase.

Materials and methods

A total of 160 pigs (9.95 kg BW) were allotted to 5 treatments -, Control (100 % NRC Ca, P with TCP), TCP (70 % NRC Ca, P with TCP), TCPP (TCP + 500 FTU phytase), MCP (70 % NRC Ca, P with MCP) and MCPP (MCP + 500 FTU phytase). The corn-soy based basal diets were formulated to 3 450 Kcal DE/kg and 18.5 %, 16 % CP for weaning and growing period, respectively.

Results and discussion

MCPP significantly improved weight gain ($P < .05$) and other treatments were inferior to control in weight gain. Pigs fed 70 % Ca, P showed a trend to consme more feed than pigs fed control diet regardless of phytase addition. TCP and MCP treatments showed worse feed conversion compared to control, but when phytase was added, feed conversion was improved to the level of control. Between inorganic phosphorus sources, MCP was better in improving weight gain and feed conversion than TCP ($P < .05$), and phytase addition was highly significant in improving weight gain and feed conversion ($P < .01$). Nutrients digestibility of pigs fed TCP and MCP diets were lower than that of pigs fed control diets, however, pigs fed TCPP and MCPP diets showed similar rate of nutrients digestibility with that of pigs fed control diet ($P < .05$). Phytase addition improved not only phosphorus digestibility, but also digestibility of dry matter and crude protein which can be supported by the report of Jongbloed *et al*. (1992, 1993), and Wenk *et al*. (1993). Dry matter excretion was substantially reduced by phytase addition ($P < .05$). Nitrogen and phosphorus excretion showed the same trend with dry matter excretion ($P < .05$). In growing period, pigs fed TCPP and MCPP diets excreted 31 % less amounts of phosphorus than pigs fed control

diet. When the amount of excretion was converted to the amount of excretion per 100 kg weight gain, pigs fed TCPP diet excreted 24.2 % less phosphorus than control, and MCPP excreted 47.5 % less phosphorus than control.

Table 1. Effects of phytase supplementation on growth performance of weaning-growing pigs

Item	Control	70 % P required by NRC				SEM
		TCP	TCPP	MCP	MCPP	
Weaning Period (O to 21 days)						
Initial body wt (kg)	9.9	9.9	9.9	9.9	9.9	0.01
Final body wt (kg)	21.0^{ab}	20.2^{b}	20.7^{ab}	20.6^{ab}	21.5^{a}	0.16
Average daily gain (g)	527^{ab}	486^{b}	-512^{ab}	507^{ab}	551^{a}	7.77
Feed intake (g)	908	960	931	941	951	9.66
Feed/gain	1.72^{c}	1.99^{a}	1.82^{bc}	1.86^{b}	1.72^{c}	0.03
Growing period (22 to 64 days)						
Final body wt (kg)	45.1^{b}	43.6^{bc}	43.4^{c}	44.5^{bc}	48.5^{a}	0.48
Average daily gain (g)	574^{b}	558^{b}	541^{b}	569^{b}	643^{a}	9.29
Feed intake (g)	1 355^{b}	1 406^{ab}	1 349^{b}	1 477^{ab}	1 502^{a}	22.71
Feed/gain	2.36^{ab}	2.53^{ab}	2.49^{ab}	2.60^{a}	2.34^{b}	0.04
Overall period (O to 64 days)						
Initial body wt (kg)	9.9	9.9	9.9	9.9	9.9	0.01
Final body wt (kg)	45.1^{b}	43.6^{bc}	43.4^{c}	44.5^{bc}	48.5^{a}	0.48
Average daily gain (g)	558^{b}	534^{bc}	531^{c}	549^{bc}	613^{a}	7.59
Feed intake (g)	1 216^{b}	1 268^{ab}	1 200^{b}	1 309^{a}	1 318^{a}	16.28
Feed/gain	2.18^{b}	2.38^{a}	2.26^{ab}	2.39^{a}	2.15^{b}	0.03

Contrasts	ADG (O to 64 days)	ADFI (O to 64 days)	F/G (O to 64 days)
Control vs 70 % P + phytase	NS	NS	NS
TCP vs MCP	0.0001	0.0192	NS
No phytase vs phytase	0.0023	NS	0.0038

1 TCP: 70 % Ca, P of NRC (1988) requirements supplied by tricalcium phosphate; TCPP: TCP + 500 FTU phytase; MCP: 70% Ca, P of NRC (1988) requirements supplied by monocalcium phosphate-, MCPP: MCP + 500 FTU phytase.
a, b Means in the saine row with different superscripts differ (P < .05).
* Not significant

Table 2. Effect of phytase on nutrient excretion per 100 kg weight gain (kg).

Item	Control	70 % P required by NRC				SEM
		TCP	TCPP	MCP	MCPP	
Weaning Period (0 to 21 days)						
Initial body wt (kg)	41.68^{c}	56.05^{a}	43.03^{c}	49.13^{b}	40.43^{c}	1.48
Final body wt (kg)	1.33^{b}	1.80^{a}	1.38^{b}	1.62^{a}	1.32^{b}	0.05
Average daily gain (g)	0.73^{c}	0.98^{a}	0.60^{d}	0.86^{b}	0.56^{d}	0.04
Growing period (22 to 64 days)						
Final bodyweight (kg)	66.02^{bc}	72.54^{ab}	70.64^{ab}	75.46^{a}	59.03^{c}	1.63
Feed intake (g)	2.05^{bc}	2.26^{ab}	2.13^{ab}	2.33^{a}	1.82^{c}	0.05
Feed/gain	1.18^{a}	1.15^{ab}	0.95^{c}	1.07^{b}	0.80^{d}	0.03

Contrasts	A	B	C
Weaning Period (O to 21 days)			
Dry matter	NS	0.0102	0.0001
Nitrogen	NS	0.0777	0.0001
Phosphorus	0.0004	0.0101	0.0001
Growing Period (22 to 64 days)			
Dry matter	NS	0.0939	0.0019
Nitrogen	NS	NS	0.0028
Phosphorus	0.0001	0.0013	0.0001

Abbreviations as detailed in table 1.
a, b, c, d: Means in the same row with different superscripts differ (P < .05).
A: Control vs 70 % phosphorus + phytase; B: TCP vs MCP; C: No phytase vs phytase.

Conclusions

It was found that MCP is more efficient inorganic P source than TCP for pigs. And with proper inorganic P source and phytase, P contents in weaning-growing pig diet could be reduced by 30 %.

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