Xylanase and Phytase Supplementation on Growth Performance of Grower Pigs

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Summary

The nutritional value of wheat millrun with xylanase and (or) phytase supplementation in wheat based diets for growing pigs was evaluated. Wheat millrun inclusion depressed energy and P digestibility and also ADG, but had not effect on ADFI and G:F. Xylanase and phytase reduced ADFI and improved nutrient digestibility. However, the improved nutrient digestibility did not result in improved growth performance.

Introduction

Feed cost might be reduced or nutrient intake might be enhanced if nutrients bound by the arabinoxylan and phytate of wheat millrun could be released through enzyme supplementation to a higher extent. This would allow for large inclusion rates of wheat millrun into swine diets, while maintaining growth performance. An increased energy and amino acid digestibility in the small intestine is especially beneficial to the pig, but increased energy digestibility in the large intestine will also be beneficial to improve the energy status. Improved utilization of dietary phosphorus will be beneficial economically, but will also reduce the pressure of swine production on the environment.

"Wheat millrun inclusion depressed energy and P digestibility and also ADG."

Table 1. Ingredient and Nutrient Composition Data

Ingredient (%)	Wheat	20% Wheat millrun[z]	40% Wheat millrun[z]
Wheat	83.26	61.83	40.26
Wheat millrun	-	20.00	40.00
Soybean meal	12.50	12.50	12.50
Canola oil	-	1.80	3.60
Dicalcium phosphate	1.20	0.70	0.40
Limestone	0.85	1.00	1.10
L-lysine HCl	0.49	0.47	0.45
Vitamin premix[y]	0.50	0.50	0.50
Mineral premix[w]	0.50	0.50	0.50
Sodium bicarbonate	0.29	0.29	0.29
Salt	0.20	0.20	0.20
L-Threonine	0.15	0.14	0.13
DL-Methionine	0.06	0.07	0.07
Calculated nutrient content			
DE (Mcal kg^{-1})	3.34	3.34	3.34
Dig. Lysine (g Mcal^{-1} DE)[v]	2.80	2.80	2.80
Calcium	0.70	0.70	0.70
Total phosphorus	0.60	0.60	0.63

[z] Xylanase was included at a rate of 167 g Tonne^{-1} of finished feed and phytase at a rate of 100 g Tonne^{-1} of finished feed.
[y] Provided per kilogram of premix: vitamin A, 1 650 000 IU; vitamin D_3, 165 000 IU; vitamin E, 8000 IU; niacin, 7 g; D-pantothenic acid, 3 g; riboflavin, 1g; menadione, 800 mg. folic acid, 400 mg; thiamine, 200 mg; D-biotin; 40 mg; vitamin B_{12}, 5 mg
[w] Provided per kilogram of premix: Zn, 20 g; Fe, 16 g; Cu, 10 g; Mn, 5 g; I, 100 mg; Se, 20 mg.
[v] Contained by calculation 2.80 apparent digestible lysine Mcal^{-1} DE (0.94% apparent digestible lysine) and an ideal pattern of digestible amino acids compared to lysine (%); lysine 100; threonine 60; methionine 30 (NRC 1998).

Experimental Procedure

Digestibility study: Eight diets based on wheat and either 20 or 40% wheat millrun without enzyme, or with xylanase and (or) phytase (Table 1) were tested in a 2 x 2 x 2 factorial arrangement together with a wheat control diet in 3 separate periods in 18 cannulated pigs, according to a three-period change over design for a total 54 observations of six observations per diet.

Performance Study: 72 pigs (PIC, initial BW 30 kg) were fed one of the nine experimental diets each for 35 days. The experimental diets were fed in one period in eight blocks (four barrow for gilts), for a total of 72 observations or eight observations per diet. Average daily gain, ADFI, and feed efficiency were determined on a weekly basis.

Results and Discussion

Ileal and total tract energy digestibility was affected by millrun inclusion, xylanase and phytase addition. Millrun addition reduced P digestibility linearly and phytase and xylanase supplementation improved P digestibility. In contrast to digestibility data, performance data were less conclusive. Millrun inclusion reduced ADG linearly, but did not affect ADFI or G:F. Xylanase and phytase reduced ADFI, and phytase tended to reduce ADG . Enzyme supplementation did not affect final BW or G:F.

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Table 2. Effect of wheat millrun inclusion level and enzyme supplementation on ileal and total-tract energy and DM digestibility and DE content of diets fed to grower pigs

	Millrun (%)								
	0	20				40			
Variable	Control	Control	Xylanase	Phytase	X+P	Control	Xylanase	Phytase	X+P
Ileal									
Energy digestibility (%)	77.5^{a}	68.1^{bcd}	72.4^{b}	71.6^{bc}	72.5^{b}	62.0^{e}	68.1^{bcd}	67.4^{cd}	66.6^{d}
DE (kcal kg^{-1} DM)	3416^{a}	3097^{b}	3292^{ab}	3262^{ab}	3318^{ab}	2896^{c}	3199^{ab}	3141^{b}	3129^{b}
DM digestibility (%)	79.4^{a}	69.9^{c}	73.9^{b}	73.8^{b}	74.2^{b}	63.4^{d}	69.2^{c}	68.7^{c}	67.9^{c}
Total-tract									
Energy digestibility (%)	84.4^{a}	77.6^{c}	79.8^{b}	78.9^{bc}	80.7^{b}	71.5^{f}	75.5^{d}	73.4^{e}	73.1^{e}
DE (Kcal kg^{-1} DM)	3720^{a}	3528^{d}	3632^{bc}	3596^{cd}	3692^{ab}	3337^{f}	3548^{cd}	3424^{e}	3433^{e}
DM digestibility (%)	86.7^{a}	80.3^{c}	82.2^{b}	81.7^{b}	83.1^{b}	74.2^{f}	77.9^{d}	76.1^{e}	75.9^{e}
Total-tract minus ileum									
Energy digestibility (%)	6.9	9.5	7.5	7.3	8.2	9.4	7.6	6.1	6.5
DE (kcal kg^{-1} DM)	304	430	340	334	374	441	359	282	303

NS: Not significant
^{Abcd} Means within the same row with the same letter are not different P>0.05.
y:: Linear and quadratic responses were analyzed using 0%, 20%, and 40% control diets.
^{z} Source of variation and probability only among diets that contain millrun and/or enzyme.
Xyl: Xylanase.
Phy: Phytase.

Table 3. Effect of millrun and enzymes on performance of grower pigs over time

		Millrun (%)							
	0	20				40			
Age	Control	Control	Xylanase	Phytase	X+P	Control	Xylanase	Phytase	X+P
Average daily feed intake (kg d^{-1})									
0-35	2.6^{a}	2.6^{a}	2.4^{bc}	2.4^{bc}	2.3^{c}	2.5^{ab}	2.4^{bc}	2.4^{bc}	2.3^{c}
Average daily gain (kg d^{-1})									
0-35	1.05^{a}	0.98^{a}	0.99^{a}	0.92^{b}	0.95^{b}	0.94^{b}	0.91^{b}	0.93^{b}	0.92^{b}
Feed efficiency									
0-35	0.41	0.39	0.42	0.39	0.42	0.41	0.39	0.39	0.41
Final body weight (kg)									
d 35	76.8^{a}	70.3^{b}	70.1^{b}	67.5^{c}	68.7^{b}	68.5^{b}	67.5^{c}	68.3^{b}	67.7^{c}

NS: Not significant
^{Abcd} Means within the same row with the same letter are not different P>0.05.

Conclusions

Overall, millrun inclusion reduced nutrient digestibility and growth performance. Xylanase and phytase improved nutrient digestibility; however, the improved digestibility did not result in improved growth performance, perhaps indicative of a nutrient imbalance.

Acknowledgements

Program funding was provided by Sask Pork, Alberta Pork, Manitoba Pork and Saskatchewan Agriculture and Food Development Fund. Danisco Animal Nutrition funded the project.

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