

The Effects of Cereal Type and Xylanase Supplementation on Pig Growth Performance and Energy Digestibility

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Summary and Implications

Two studies were conducted to determine the effects of cereal type (corn v. wheat) and xylanase supplementation (with vs. without) on energy digestibility and growing pig performance. In Exp. 1, 440 pigs (initial BW 7.8 ± 2.4 kg) were randomly allotted to 1 of 4 dietary treatments and used in a 28-d growth study. No significant cereal \times enzyme interactions or main effects of cereal and enzyme were observed for any of the growth criteria evaluated ($P > 0.84$). In Exp. 2, 72 pigs from Exp. 1 were used in a metabolism study. Pigs remained on the same dietary treatment as in Exp. 1. Feces were collected, and apparent total tract digestibility (ATTD) of dry matter (DM) and gross energy (GE) were determined. A cereal \times xylanase interaction was observed ($P < 0.0001$) for ATTD of DM and GE due to xylanase supplementation improving both ATTD of DM and GE in corn-based diets (85.6 v 87.6 % and 85.4 v 87.4 %, respectively), but decreasing ATTD of DM and GE in wheat-based diets (89.3 v 86.3 % and 89.7 v 86.6 %, respectively). Thus, the effects of xylanase supplementation on DM and GE digestibility may depend on cereal type, and increases in DM and GE may be observed when xylanase is added to corn based diets.

Introduction

The typical diet utilized by the American swine industry is changing very rapidly, from the very simple corn-soybean meal formulations of the past to a much greater use of co-products and by-products. Economics is the driving force behind this change, as the rapid expansion of the biofuel sector has re-directed a substantial portion of the corn crop away from livestock feed. A major consequence of this change is the increased fiber levels in modern swine diets, due to the inclusion of higher fiber co-products. The shift to more fibrous diets has caused producers to look to new technologies, such as exogenous enzymes, as a means to enhance growth performance and lower feed costs.

Thus, we have chosen to investigate a pure exogenous xylanase due to the particular fiber structure of our selected cereal grains, corn and wheat. Corn and wheat both contain arabinoxylan, which is a hemicellulosic constituent of the plant cell wall and is made up of a β -1, 4 linked D-xylopyranosyl residues. The mechanism of exogenous xylanase has been thought to act upon arabinoxylans by

cleaving glycosidic bonds in the xylan main chain. By breaking the xylan main chain, bound glucose can then be released from the fiber structure. Consequently, we could see an increase in performance due to the greater availability of energy substrate. Thus, the objective of our study was to investigate the effects of cereal type and xylanase supplementation on the growth performance and energy digestibility in growing pigs.

Materials and Methods

In both experiments, treatments were arranged as a 2×2 factorial with the main effects of cereal type (corn v. wheat) and xylanase supplementation (0 v 16,000 U/kg; Econase XT®, AB Vista, Marlborough, UK).

In Exp. 1, 440 growing pigs (initial BW of 7.8 ± 2.4 kg) were used in a 28-d growth study. Pigs were randomly allotted to 1 of 4 dietary treatments based on initial weight. There were 10 replications per treatment with 11 pigs per pen and an equal number of barrows and gilts across treatments. Pigs had *ad libitum* access to feed and water for the duration of the study. Average daily gain, ADFI, and G:F were determined by weighing pigs and measuring feed disappearance on d 0, 13, and 28.

In Exp. 2, 72 growing pigs from Exp. 1 were used in a 14 d metabolism study. This study was carried out over two collection periods, with 9 pigs (initial BW 17.9 ± 0.55 kg) per collection period, that were randomly selected from each treatment in Exp. 1 and moved to individual pens for 14 d. Pigs remained on the same cereal type and xylanase treatment as in Exp. 1. The only difference between dietary treatments in Exp. 1 and Exp. 2 was the protein source. In Exp. 1 the primary source of protein was soybean meal and in Exp. 2 the primary protein source was casein. We utilized casein in this study so that the only fiber present in the diet would be of corn or wheat origin. Pigs had *ad libitum* access to feed and water for the duration of the study. On d 12, 13, and 14 feces were collected and ATTD was determined for DM and GE.

Treatments were arranged as a 2×2 factorial for both experiments and data was analyzed using the PROC MIXED procedure of SAS (SAS Institute Inc., Cary, NC). In Exp. 1 pen was the experimental unit and in Exp. 2 pig was the experimental unit. When significant interactions ($P < 0.05$) were observed, LSD's were used to evaluate the means. Results were considered significant at $P \leq 0.05$ and considered a trend at $P \leq 0.10$.

These studies are a part of larger project aimed at better understanding the process of digestion, as well as the physical and chemical environment, along the length of the gastrointestinal tract of the pig as influenced by diet type

and exogenous enzyme supplementation. Results for subsequent portions of this project will be forthcoming.

Results and Discussion

In Exp. 1, there were no significant cereal x enzyme interactions or main effects of cereal and enzyme observed for any of the growth criteria evaluated ($P > 0.05$; Table 1). However, from d 13 to 28, there was a tendency ($P = 0.07$) for pigs fed diets supplemented with xylanase to have improved ADG compared to pigs fed unsupplemented diets.

In Exp. 2, a cereal \times xylanase interaction was observed ($P < 0.0001$; Table 2) for ATTD of DM and GE, which was primarily due to xylanase supplementation improving both ATTD of DM and GE in corn-based diets (85.6 v 87.6 % and 85.4 v 87.4 %, respectively), but decreasing ATTD of DM and GE in wheat-based diets (89.3 v 86.3 % and 89.7 v 86.6 %, respectively). Thus, the efficacy of xylanase supplementation on DM and GE digestibility may be dependent on cereal type and the addition of xylanase to corn-based diets may increase ATTD of DM and GE.

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Table 1. Effects of basal diet and xylanase supplementation on growing pig performance, Exp. 1¹

Item	Corn		Wheat		SEM	<i>P</i> <		
	- xylanase ²	+ xylanase	- xylanase	+ xylanase		Grain × Enzyme	Grain	Enzyme
d 0 to 13								
ADG, kg	0.29	0.32	0.30	0.28	0.02	0.15	0.53	0.64
ADFI, kg	0.39	0.41	0.40	0.42	0.03	0.84	0.50	0.23
G:F	0.762	0.783	0.753	0.687	0.043	0.32	0.24	0.61
d 13 to 28								
ADG, kg	0.56	0.59	0.58	0.60	0.01	0.81	0.36	0.07
ADFI, kg	0.83	0.86	0.84	0.85	0.02	0.61	0.84	0.32
G:F	0.676	0.683	0.689	0.705	0.011	0.70	0.14	0.34
d 0 to 28								
ADG, kg	0.43	0.46	0.45	0.45	0.01	0.17	0.94	0.10
ADFI, kg	0.62	0.65	0.63	0.64	0.01	0.47	0.97	0.11
G:F	0.698	0.711	0.708	0.700	0.009	0.28	0.96	0.81

^{a,b,c} Means without a common superscript within a row differ ($P < 0.05$).

¹ A total of 440 growing pigs (initial BW 8 kg) were used in a 28-d growth study. Pigs were randomly allotted to 1 of 4 treatments with 10 replications per treatment and 11 pigs per pen

² Econase XT (AB Vista; Marlborough, UK)

Table 2. Effects of basal diet and xylanase supplementation on DM and GE total tract digestibility, Exp. 2¹

Item	Corn		Wheat		SEM	<i>P</i> <		
	- xylanase ²	+ xylanase	- xylanase	+ xylanase		Grain × Enzyme	Grain	Enzyme
DM	85.62 ^c	87.57 ^b	89.34 ^a	86.26 ^{bc}	0.48	0.0001	0.013	0.24
GE	85.41 ^c	87.38 ^b	89.66 ^a	86.62 ^{bc}	0.49	0.0001	0.0007	0.29

^{a,b,c} Means without a common superscript within a row differ ($P < 0.05$).

¹ A total of 72 pigs (initial BW ~ 20 kg) were used in a 14-d study over two replications with 36 pigs per replication. Pigs were randomly allotted to 1 of 4 treatments and placed in individual crates.

² Econase XT (AB Vista; Marlborough, UK)