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Short communication

## Dietary inclusion of xylanase improves growth performance, apparent total tract nutrient digestibility, apparent ileal digestibility of nutrients and amino acids and alters gut microbiota in growing pigs



Kwang Yong Lee<sup>a</sup>, Balamuralikrishnan Balasubramanian<sup>a,b,1</sup>, Jong Keun Kim<sup>a</sup>, In Ho Kim<sup>a,\*</sup>

<sup>a</sup> Department of Animal Resource and Science, Dankook University, Cheonan 31116, South Korea

<sup>b</sup> Department of Food Science and Biotechnology, College of Life Science, Sejong University, Seoul 05006, South Korea

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### ABSTRACT

The study investigated the effects of dietary inclusion of xylanase on growth performance, apparent total tract digestibility (ATTD) of dry matter (DM), nitrogen (N), gross energy (GE), apparent ileal digestibility (AID) of nutrients and amino acids, and faecal and ileal microflora counts in twelve cannulated growing pigs fed corn-soybean meal based diet. Pigs with a body weight of  $24.32 \pm 1.77$  kg were surgically equipped with T-cannulas and randomly allotted to one of four dietary treatments (basal diet supplemented with 0, 450, 900, and 1800 of xylanase U/kg) for a 21-days trial period. Dietary inclusion of xylanase significantly improved daily gain and tended to improve gain: feed ratio ( $P = 0.048$ ;  $0.089$ , respectively). It also improved AID of DM, N, and GE ( $P = 0.042$ ;  $0.084$ ; and  $0.093$ , respectively). The AID of histidine and glutamic acid were significantly improved by xylanase supplementation ( $P = 0.015$  and  $0.021$ ) while the AID of lysine, methionine and threonine tended to be improved ( $P = 0.097$ ;  $0.082$ ; and  $0.086$ , respectively). Xylanase supplementation also increased counts of faecal and ileal *Lactobacillus* ( $P = 0.036$  and  $0.048$ , respectively) and reduced counts of faecal and ileal *E. coli* ( $P = 0.007$  and  $0.071$ , respectively). In conclusion, dietary inclusion of xylanase improved growth performance, AID of nutrients and amino acids and had beneficial effects on faecal and ileal microflora, increasing *Lactobacillus* and reducing *E. coli* counts in pigs.

### 1. Introduction

Corn-soybean meal (SBM) based diets are used globally for pigs. However, corn and SBM contain 10% and 20% non-starch polysaccharides (NSP) respectively and can adversely affect the nutritional value of such diets, as monogastrics do not produce the xylanase (CVB, 1998; Li et al., 2010; Moeser et al., 2002; van Kempen et al., 2006). Exogenous xylanase has been used to improve the digestibility of energy by breaking down arabinoxylans that are poorly digested in pigs (Barrera et al., 2004) and to enhance nutrient

**Abbreviations:** BW, body weight; ADG, average daily gain; ADFI, average daily feed intake; ATTD, apparent total tract digestibility; AID, apparent ileal digestibility; DM, dry matter; N, nitrogen; GE, gross energy; G:F, gain feed ratio; NSP, non-starch polysaccharides; SBM, soybean meal

\* Corresponding author.

E-mail address: [inhokim@dankook.ac.kr](mailto:inhokim@dankook.ac.kr) (I.H. Kim).

<sup>1</sup> Equal contributor as first author.

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**Table 1**  
Ingredient composition of basal experimental diet (g/kg, as-fed basis).

Items	Content
<b>Ingredients</b>	
Corn	553.8
Soybean meal	334.4
Molasses	25.0
Animal Fat	53.3
Dicalcium phosphate	19.3
Limestone	7.8
L-Lysine HCL	1.7
Trace mineral premix <sup>a</sup>	1.1
Vitamin premix <sup>b</sup>	1.2
Salt	2.1
Choline chloride	0.3
<b>Calculated composition</b>	
ME (MJ/kg)	14.06
NE (MJ/kg)	9.84
Crude protein (%)	20.00
Lysine (%)	1.30
Calcium (%)	0.90
Phosphorus (%)	0.80
<b>Analyzed composition</b>	
GE (MJ/kg)	17.22
Crude Protein (%)	19.65
Calcium (%)	0.87
Phosphorus (%)	0.76
Lysine	1.52
Digestible lysine	1.46
Methionine	0.62

<sup>a</sup> Provided per kg of complete diet: 12.5 mg Mn, 179 mg Zn, 140 mg Cu, 0.5 mg I and 0.4 mg Se.

<sup>b</sup> Provided per kg of complete diet: 20,000 IU of vitamin A; 4000 IU of vitamin D3; 80 IU of vitamin E; 16 mg of vitamin K3; 4 mg of thiamine; 20 mg of riboflavin; 6 mg of pyridoxine; 0.08 mg of vitamin B12; 120 mg of niacin; 50 mg of Ca-pantothenate; 2 mg of folic acid and 0.08 mg of biotin.

values of corn-based diets for pigs (Li et al., 2010; Passos et al., 2015). However, pigs receiving dietary xylanase supplementation do not always show consistent improvement in growth performance or nutrient digestibility (Atakora et al., 2011; Barrera et al., 2004; Leek et al., 2007; Widyaratne et al., 2009). The effects of exogenous xylanase supplementation on nutrient digestibility and performance can be influenced by the type and dose of xylanase used, diet composition and the physiological status of the animal (Fang et al., 2007). The present study was conducted to investigate the effects of a 1, 4-beta xylanase on the performance, apparent nutrient digestibility and the some aspects of the faecal and ileal microflora of growing pigs fed a corn based SBM diet.

## 2. Materials and methods

### 2.1. Ethical statement

The experimental protocols describing the management and care of animals were reviewed and approved by the Animal Care and Use Committee of Dankook University, Cheonan, South Korea.

### 2.2. Experimental design, diets, animals, and housing

Twelve [(Landrace × Yorkshire) × Duroc] growing pigs with average body weight (BW) of 24.32 ± 1.77 kg were surgically equipped with simple T-cannulas approximately 15 cm prior to the ileocecal junction according to procedures described by Sauer et al. (1983). Pigs were allocated to one of four dietary treatments: basal diet supplemented with 0, 450, 900 or 1800 of xylanase U/kg (*endo*-1,4-β-xylanase, derived from *Bacillus subtilis*, Nutrase-Xyla<sup>®</sup>, Nutrex Nv<sup>™</sup>, Belgium). There were three replicates per treatment for a 21-day trial period. Diets (Table 1) in mash form were formulated to meet or exceed the requirements suggested by the NRC (2012). The pigs were fasted for 16–20 h prior to surgeries. After the surgery, pigs were transferred to individual pens (1.2 × 0.6 m) in a temperature-controlled room (28 °C) and allowed to recover for 10 days prior to the initiation of the trial as previously described by Li et al. (1994). Daily feed allowance was 0.05 × BW<sup>0.9</sup> based on the recommendation of Armstrong and Mitchell (1955). The daily feed was provided as two meals at 12 h interval (08.00 and 20.00 h), and water was provided *ad libitum*.

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