

Different fibre sources fed to weaner pigs influence production performance and acute phase protein levels

J.R. Pluske¹, A. Hernandez¹, J. Mansfield¹ and J.C. Kim²

¹Murdoch University, Murdoch, WA 6150. ²Department of Agriculture and Food WA, South Perth, WA 6151.

Dietary fibre is fermented by microbiota in the distal gastrointestinal tract (GIT) to short-chain fatty acids (SCFA). Previous studies (e.g., Pluske *et al.*, 2002) have shown differential effects of SCFA on growth performance and the incidence of disease such as post-weaning diarrhoea (PWD), however more recently the SCFA have become recognised as potential mediators in inflammatory and immune functions in the GIT (Vinolo *et al.*, 2011). This experiment examined the effects of infection with an enterotoxigenic strain of *E. coli* on pig performance, SCFA production, and biomarkers of inflammation after weaning.

A total of 80 Large White x Landrace pigs obtained at weaning (21 d of age; 6.78±0.121 kg, mean±SEM) were fed five experimental diets as follows: (1) rice-based diet (R), (2) rice diet with inulin (R+I); (3) rice diet with lupin hulls (R+LH), (4) rice diet with inulin and lupin hulls (R+I+LH), and (5) commercial diet based on wheat and barley (C). None of the diets contained antimicrobial compounds, and were balanced for the digestible energy (DE) (14.9 MJ DE/kg) and available lysine (1.25%) contents. Each treatment had four replicate pens with four pigs per pen. Pigs were fed *ad libitum* for 4 weeks. All pigs were challenged with an enterotoxigenic strain of *Escherichia coli* (*E. coli*) serotype O149:K91:K88 at 72, 96 and 120 h after weaning. The diarrhoea index and faecal shedding of *E. coli* were assessed according to Heo *et al.* (2009). Two medium-weight pigs per pen were bled on d 7, 14 and 21 to measure circulating levels of haptoglobin (Hp) and C-reactive peptide (CRP), biomarkers of an inflammatory response in the GIT (Petersen *et al.*, 2004). On d 21 of the experiment one pig, of median weight, from each pen of the R, R+I+LH and C diets (four pigs per treatment) was humanely euthanised, and digesta samples from the mid colon were collected and appropriately stored until analysed for SCFA concentration using gas liquid chromatography. Data were subjected to one-way ANOVA using SPSS Statistics (version 21; IBM).

Table 1. Performance (d 1-28 after weaning) and fermentation characteristics of digesta in weaner pigs fed different fibre sources.

	Diet					SEM ⁷	Significance
	R ⁶	R+I	R+LH	R+I+LH	C		
Number ¹	4	4	4	4	4		
ADG ² (g/d)	351 ^{ac}	287 ^b	339 ^{ab}	384 ^a	326 ^{bc}	17.4	0.025
ADFI ³ (g/d)	502 ^{ac}	434 ^b	476 ^{ab}	527 ^c	453 ^b	14.1	0.003
FCR ⁴ (kg/kg)	1.42	1.50	1.41	1.40	1.40	0.035	0.858
Total SCFA ⁵	11 ^a	-	-	14 ^a	42 ^b	5.70	0.007
Colon (mM/organ)							

^{a,b,c}Means in a row not having the same superscript are significantly different (P<0.05); ¹Number, number of replicates; ²ADG, average daily gain; ³ADFI, average daily feed intake; ⁴FCR, feed conversion ratio; ⁵SCFA, short-chain fatty acids; ⁶See text for details of diets; ⁷SEM: standard error of mean.

Pigs fed diets R and R+I+LH grew faster than pigs fed diet R+I (P=0.025), with pigs fed other diets being intermediate in performance. Pigs fed diet R+I+LH consumed more feed than pigs fed diets R+I, R+LH and C (P=0.003), but the same as pigs fed diet R (Table 1). There were no effects (P>0.05) of treatment on FCR, diarrhoea index (d 0-14), *E. coli* score (from faecal swabs) or the number of pigs treated therapeutically with antibiotics. Levels of Hp and CRP were higher (P<0.05) only in C-fed pigs on d 14 and on d 14 and 21, respectively. The SCFA concentration in the mid colon was highest (P=0.007) in pigs fed diet C, but similar for those fed diets R and R+I+LH. These data suggest diet-specific changes, most likely attributable to production and (or) production patterns of SCFA, in the production of acute phase proteins in the pig after weaning. There were no effects of the different diets on PWD in this experiment.

HEO, J.M., KIM, J.C., HANSEN, C.F., MULLAN, B.P., HAMPSON, D.J. and PLUSKE, J.R. (2009). *Journal of Animal Science*. **87**:2833-2843.

PETERSEN, H.H., NIELSEN, J.P. and HEEGAARD, P.M.H. (2004). *Veterinary Research*. **35**:163-187.

PLUSKE, J.R., PETHICK, D.W., HOPWOOD, D.E. and HAMPSON, D.J. (2002). *Nutrition Research Reviews*. **15**:333-371.

VINOLO, M.A.R., RODRIGUES, H.G., NACHBAR, R.T. and CURL, R. (2011). *Nutrients*. **3**:858-876.

Supported by Murdoch University.