

Feeding a low protein amino-acid supplemented diet after weaning reduces incidence of post-weaning diarrhoea

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Post-weaning diarrhoea (PWD), a condition associated with proliferation of β -haemolytic strains of *Escherichia coli* in the small and large intestine, often occurs after weaning. Once attached to the small intestinal epithelium, these strains of *E. coli* can disrupt digestive and absorptive functions of the enterocytes by releasing both heat labile toxins (LT) and heat stable toxins (ST; variants STa and STb) that are responsible for hypersecretory diarrhoea (Pluske *et al.*, 2002). Numerous dietary strategies have been attempted to ameliorate the losses associated with PWD. Of these, feeding a lower-protein diet with supplementation of essential amino acids has been suggested because by-products of protein fermentation, such as ammonia and amines, are implicated in the aetiology of the condition (Aumaitre *et al.*, 1995). However feeding a lower-protein diet after weaning is associated with reductions in performance (Nyachoti *et al.*, 2006). In this study, we hypothesized that feeding a low protein diet for a short period of time after weaning would reduce PWD by reducing protein fermentation in the LI.

Seventy-two female pigs (Large White \times Landrace) aged 21 days and weighing 5.9 ± 0.12 kg (mean \pm SEM) were randomly allocated to six treatments based on weaning weight. The treatments were: high protein diet (24% CP) for day 14 (HP14); low protein amino-acid supplemented diet (18% CP) for either day 14 (LP14) or day 7 (LP7). Half of the pigs ($n=12$) per treatment were infected (I) with 3 mL, 8 mL and 8 mL (107 CFU/mL) of *E. coli* (serotype O149; K91; K88) at 72, 96 and 120 hours after arrival, respectively. Diet LP was fortified with lysine, methionine, tryptophan, threonine, isoleucine and valine, based on proposed ideal amino acid patterns. An intermediate diet (20.5% CP) was fed to pigs at the conclusion of each treatment. None of the diets contained antimicrobial compounds. Rectal swabs were scored according to the number of positive streaked sections (0-5) on days zero, five, seven, 10 and 14. Plasma urea nitrogen (PUN) was measured on day seven and 14. Diarrhoea was recorded for the first 14 days. Repeated-measures analysis of variance (SPSS Inc v.14.0, SAS Inc) was used to analyze the results.

Infection increased *E. coli* shedding ($P < 0.001$) and the DI ($P < 0.001$) (Table 1). Piglets fed a low-protein diet both for seven and 14 days after weaning showed lower levels of PUN ($P < 0.001$) and the DI ($P < 0.001$) than piglets fed a high-protein diet. The effects of PL on the decreased PUN and DI were independent of *E. coli* infection. These results support our hypothesis that feeding a lower-protein, amino-acid supplemented diet for a shorter period of time after weaning reduces PWD by reducing the protein load entering the hindgut of the young pig.

Table 1. Effect of a low protein diet on shedding of β -haemolytic *E. coli*, PUN and DI2.

Infection	Non- infected			Infected			P-value			
	HP14	LP14	LP7	HP14	LP14	LP7	SEM	PL ¹	I	PL \times I
<i>E. coli</i> score	0.3	0.1	0.1	0.6	0.6	0.5	0.11	0.373	<0.001	0.490
PUN	5.2 ^a	2.1 ^c	3.4 ^b	5.6	2.2	3.9	0.59	<0.001	0.467	0.944
DI2	19.8 ^a	8.5 ^c	9.6 ^b	44.2 ^a	31.6 ^b	21.4 ^c	3.54	<0.001	<0.001	0.154

¹Protein level; ²Diarrhoea index: Proportion of days with diarrhoea with respect to total days (14 days) on trial.

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