

Effect of lactic acid supplementation on pancreatic secretion in pigs after weaning

**M.-J. Thaela¹, M.S. Jensen¹, S.G. Pierzynowski¹, S. Jakob²
and B.B. Jensen¹**

*¹Danish Institute of Agricultural Sciences,
Department of Animal Nutrition and Physiology
P.O. Box 50, DK-3380 Tjele, Denmark*

*²Hohenheim University, Institute of Animal Nutrition (450)
D-70599 Stuttgart, Germany*

ABSTRACT

The effect of lactic acid supplementation to the starter diet, on pancreatic secretion in pigs after weaning was studied in three crossbred piglets (Duroc, Danish Landrace and Yorkshire). The pigs were weaned at 28 days of age, and adapted to live in metabolic cages for one week, after which the piglets were surgically fitted with a pancreatic duct catheter and a duodenal T-cannula for chronic collection of the pancreatic juice. Studies were then carried out over a period of three weeks, during which the piglets were fed three times a day (at 08.00, 15.00, and 22.00 h). During period I, the piglets were fed with a standard weaner diet (control), during period II with a standard weaner diet supplemented with 2.5 % lactic acid period (lactic acid) and during period III with a standard weaner diet (control). Beginning four days after surgery, samples of pancreatic juice were taken hourly from 08.00 to 16.00 h. During period II, when lactic acid was added to the feed, the mean for all measured parameters of pancreatic secretion, except bicarbonate, increased in comparison to their values during period I. However this increase was only significant for volume and protein content. In contrast, during period III, when lactic acid was removed, there were no statistically significant changes in any of the measured parameters of pancreatic secretion compared to their values in period II. Our data strongly indicate that dietary supplementation with lactic acid stimulates pancreatic secretion in piglets after weaning.

KEY WORDS: pig, pancreas, lactic acid, protein, trypsin, bicarbonate

INTRODUCTION

The performance of piglets is often poor during the first few weeks after weaning. It has been suggested that this postweaning lag phase may be partly related

to an inability of the piglets to secrete sufficient endogenous digestive enzymes and gastric acid (Ravindran and Kornegay, 1993). Lindemann et al. (1986), and Pierzynowski et al. (1995) reported that piglets have insufficient pancreatic enzyme activity during the period shortly after weaning. One strategy that suckling pigs employ to overcome insufficient acid secretion, is the conversion of lactose, ingested in the sow's milk, to lactic acid, by lactobacilli bacteria. (Ravindran and Kornegay, 1993). Recent reports have shown that replacing feed antibiotics by acidifying agents in the diets for early weaned pigs may not only provide a prophylactic measure, but could be beneficial rather than harmful (Gabert and Sauer, 1994). Bearing all these facts in mind, our study attempts to determine the effect of adding lactic acid to the starter diet, on pancreatic secretion in pigs after weaning.

MATERIAL AND METHODS

Three crossbred piglets (Duroc, Danish Landrace and Yorkshire) were weaned at 28 days of age, and adapted to live in metabolic cages. Afterwards, the piglets were surgically fitted with a pancreatic duct catheter and a duodenal T-cannula for chronic collection of the pancreatic juice. During a period of three weeks, piglets were fed three times a day at 08.00, 15.00, and 22.00 h. All the pigs received a standard weaner diet (control) during period I; a standard weaner diet supplemented with 2.5% lactic acid (lactic acid) during period II; and a standard weaner diet (control) during period III. Beginning four days after surgery, hourly samples of pancreatic juice were taken, from 08.00 to 16.00 h. After measurement of the volume, approx. 1.5 ml of pancreatic juice was stored for analysis and the rest of the juice was reintroduced into the duodenum. Protein, bicarbonate, and digestive enzymes in the pancreatic juice were measured utilising methods described by Jensen (1997).

RESULTS AND DISCUSSION

During period II, when lactic acid was added to the feed, the mean for all measured parameters of pancreatic secretion except bicarbonate, increased in comparison to their values during period I (Table 1). However this increase was only significant for volume and protein content. During period III, when lactic acid was removed, the mean values for all measured parameters of pancreatic secretion except bicarbonate, showed a tendency to decrease when compared to period II, although none of these decreases were statistically significant.

It was previously suggested that the growth promoting effects of organic acids could be the result of an increase in nutrient digestibility, a decrease in dietary pH,

TABLE 1

The mean and standard deviation for pancreatic juice variable, per unit body-weight^{0.75}

Period	I	II	III
Diet	control	lactic acid	control
Volume, ml/kg ^{0.75} /h	5.4 ± 0.5 ^a	7.3 ± 0.6 ^b	6.6 ± 0.7 ^{ab}
Protein, mg/kg ^{0.75} /h	20.8 ± 2.7 ^a	33.2 ± 6.7 ^b	29.6 ± 10.4 ^{ab}
Trypsin, U/kg ^{0.75} /h	5.7 ± 2.2 ^a	11.0 ± 3.6 ^{ab}	10.0 ± 0.5 ^{bc}
Chymotrypsin, U/kg ^{0.75} /h	158.7 ± 43.5	186.3 ± 43.5	171.9 ± 42.9
Bicarbonate, mmol/kg ^{0.75} /h	1.2 ± 0.6	1.5 ± 0.6	1.3 ± 0.5

a, b, c – within a row, mean values with different superscripts are significant different (P < 0.05)

a lowering of gastric pH and a decrease in bacterial growth (see Gabert and Sauer, 1994). Our data strongly indicate that lactic acid supplementation of feed for piglets after weaning stimulates pancreatic secretion. Furthermore, Ravindran and Kornegay (1993) reported that low pH in the stomach stimulates the secretion of pancreatic bicarbonate. However, in our studies bicarbonate secretion was almost unaffected by lactic acid supplementation, which makes it unlikely that the stimulation of pancreatic secretion observed was via a decrease in dietary and gastric pH. More studies need to be conducted to elucidate the mechanism of this effect of lactic supplementation on pancreatic secretion

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