

Piglets adaptation during weaning: physiological changes and energy metabolism consequences.

A. Minuti, L. Bomba, M. Lizier, R. Mazza, F. Lucchini, F. Rossi, B. Paganini, F. Chegiani,
P. Ajmone Marsan and E. Trevisi

Nutrigenomics and Proteomics Research Center - PRONUTRIGEN - Università Cattolica del Sacro Cuore,
via Emilia Parmense 84, 29122 Piacenza, Italy Correspondence: erminio.trevisi@unicatt.it



Introduction

Weaning is a very critical period for piglets (Lallès et al., 2007), it involves separation from the sow and adaptation to several novelties: new environment, social condition, housing, gut microbiota and nutrition system. All these factors contribute to increase piglet susceptibility to gut disorders (e.g. diarrhea), intestinal infections, consequently mucosa inflammation with possible systemic consequences (Pié et al., 2004).

Aim

Aim of this study was to investigate the cellular and physiological mechanisms of piglet stress response and adaptation to a risky diet (high starch) during the weaning period.

18 female piglets from 7 litters of similar age and weight were investigated during the experiment.

- 6 control piglets (CTR0) were slaughtered just before weaning (28 days old)
- 12 test piglets were moved in a new farm and received a high starch diet (43,6% on DM), without antibiotic addition, and were slaughtered 6 days after transfer (34 days old)

Parameters collected just before or after slaughtering included:

- body weight and health status;
- wide hematochemical profile including serum amyloid A (SAA) and intestinal fatty acid binding protein (I-FABP);
- pH and volatile fatty acids (VFA) in ileum content;
- histological evaluation by optical microscopy of ileum, caecum and colon tissue.

Materials & Methods

The 12 test piglets were divided in two groups according to: presence (DR; 7 animals) or absence (NODR; 5 animals) of diarrhea after weaning.

Statistical evaluation:

ANOVA using the GLM procedure (SAS institute) including the group variable (CTR0, DR, NODR) in the model;

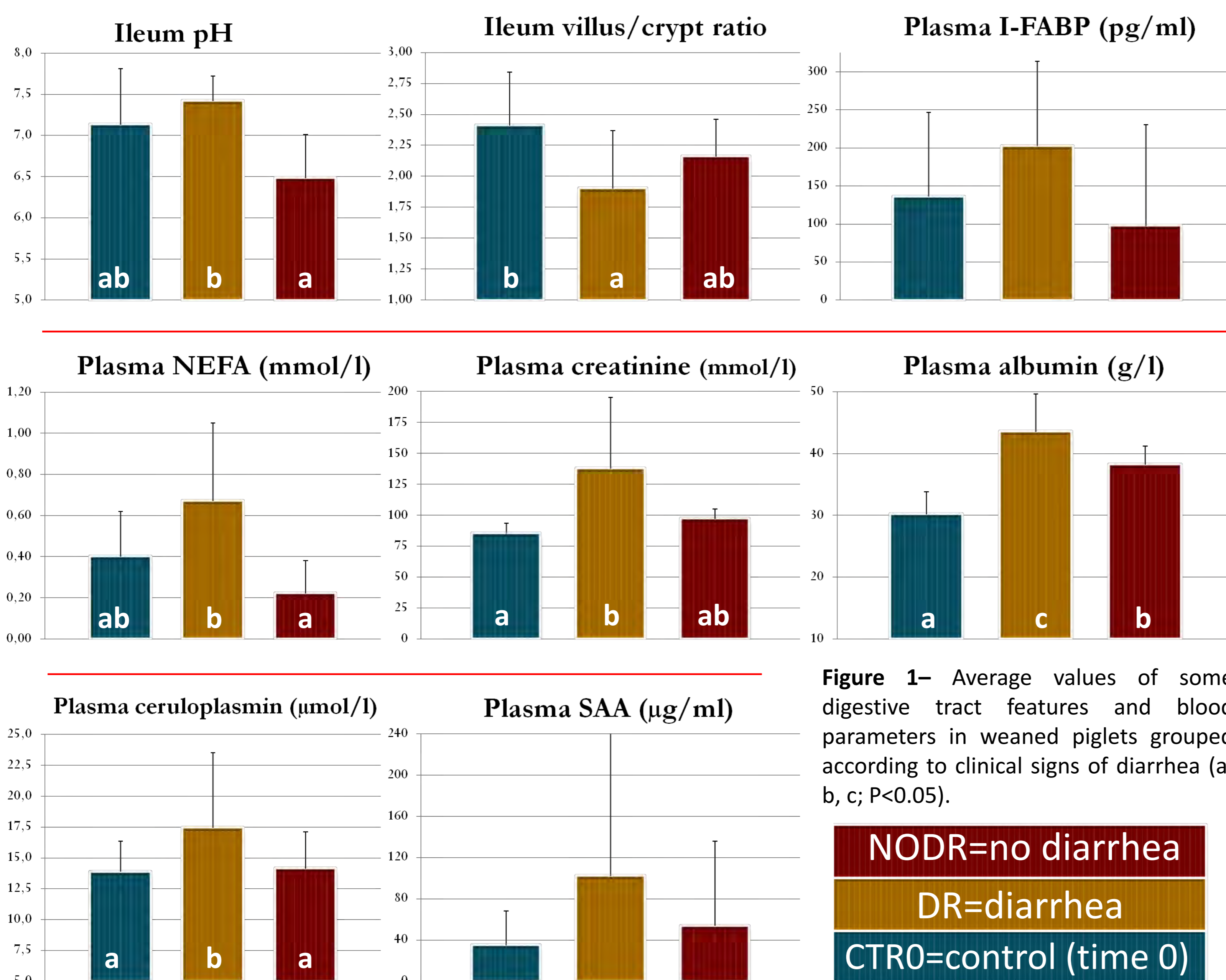


Figure 1– Average values of some digestive tract features and blood parameters in weaned piglets grouped according to clinical signs of diarrhea (a, b, c; P<0.05).

NODR=no diarrhea
DR=diarrhea
CTR0=control (time 0)

Results

DR (vs NODR) group showed: reduction of **body weight** (-149.3 vs. 38.3 g/d; P<0.01).

In the ileum

- higher pH of digesta;
- lower total VFA concentration;
- lower villus/crypt ratio.

In the blood higher levels of:

- total proteins and albumin;
- total bilirubin;
- Triglycerides, NEFA, urea and creatinine, all markers of adipose and muscle catabolism;
- inflammatory markers: ceruloplasmin, haptoglobin and SAA;
- I-FABP (markers of intestinal epithelial cell damage);

Discussion

During weaning several piglets experienced digestive disorders and showed diarrhea. In our experiments, piglets with diarrhea (DR) showed also the higher pH in the ileum. This situation seems to trigger ileum inflammatory events and to cause the decrease of the villus/crypt ratio, suggesting intestinal atrophy and damage.

This hypothesis is confirmed by:

- the higher levels of the I-FABP (NS) in DR piglets, that suggest a intestinal epithelial damage;
- the rise of the hepatic synthesis of inflammatory markers (e.g. ceruloplasmin and total bilirubin) indicating systemic consequences of above local inflammation events.

The severe impairment of the intestinal barrier function could justify the decrease of nutrient absorption in DR piglets, as indicated by energy and protein markers of tissue catabolism and body weight losses.

Conclusions

The digestive disorders occurred in piglets during weaning seem mediated by local inflammation in the intestine (atrophy and damage of epithelium).

The nutrients play a crucial role in the beginning of this phenomena (e.g. influence on ileum pH; microbiota interaction; anti-inflammatory properties); this need a further investigation and require a multidisciplinary approach.