Swine plasma immunoglobulins for prevention and treatment of post-weaning diarrhoea
Safety and Preliminary results

Hedegaard, Chris Juul; Strube, Mikael Lenz; Bendix Hansen, Marie; Kjær Lindved, Bodil; Larsen, Lars Erik; Lihme, Allan; Boye, Mette; Heegaard, Peter M. H.

Publication date: 2015

Citation (APA):
Swine plasma immunoglobulins for prevention and treatment of post-weaning diarrhoea: Safety and Preliminary results

Chris J. Hedegaard1, Mikael L. Strube1, Marie B. Hansen2, Bodil K. Lindved2, Lars E. Larsen1, Allan Lihme2, Mette Boye1, and Peter M.H. Heegaard*1

1. National Veterinary Institute, Technical University of Denmark, Frederiksberg, Denmark. 2. Upfront Chromatography A/S, Copenhagen, Denmark. *contact: PMHH@vet.dtu.dk

Background
Post-weaning diarrhoea (PWD) is a common condition in intensive swine production, resulting in reduced welfare of weaners, high consumption of antibiotics and zinc oxide, and economic losses for the farmer as a result of pig disease and death, and associated treatment costs.

Aim
To develop an antibiotic alternative, based on natural antibodies (immunoglobulins) derived directly from inexpensive raw material (swine blood plasma) for oral provision, and protection against PWD.

Conclusions
• Purified porcine immunoglobulin (ppIgG) binds PWD-inducing Enterotoxigenic Escherichia coli (ETEC), and inhibits ETEC adhesion to porcine intestinal epithelial cells in vitro.
• Experimental ETEC infection was cleared significantly faster in weaner piglets given a ppIgG feed supplement.
• Based on next-generation sequencing data, ppIgG inhibits ileal adhesion of bacteria from the family Enterobacteriaceae.
• No adverse side effects were observed by using ppIgG as a feed supplement.
• These results suggest that ppIgG could be used for treatment of PWD and reduce antibiotic consumption.

Figure 1: Purified porcine IgG (ppIgG)

Figure 2: ppIgG reacts with relevant bacteria in vitro

A: Indirect (whole cell ELISA)

B: Competitive ELISA

C: Inhibition of ETEC adhesion

Figure 3: ppIgG reduces ETEC infection in PWD model

A: Offspring of 11 sows were randomly mixed after farrowing (day -28), to avoid confounding treatment effect with the genetic background. At 28 days of age, 24 piglets were randomly selected, weaned and distributed according to their experimental group (day 0). On day 1 two groups (Infected+ppIgG and Infected) were given 2x10⁶ CFU of ETEC (E. coli F4+O149). The group ‘Infected+ppIgG’ was provided every day with oat/wheat-feed mixed with 160 ml (32 grams) of ppIgG. After 12 days the weaner piglets were killed and inspected. B: Faecal samples were collected on day 1, 3, 5, 7, 9 and 11 post infection and analysed by F4-specific qPCR for shedding of the ETEC. The infection was cleared significantly faster in the ‘infection+ppIgG’ group compared to the infection control group (p=0.0007), even though onset of infection was faster in infection+ppIgG than in the infection control group (p=0.0017). C: DNA was purified from the ileum samples (taken at autopsy). V1-V2 regions of 16S rRNA gene was amplified, and amplicons were sequenced on MiSeq platform (Illumina Inc. San Diego, USA). The resulting read counts were then analysed on the family level, which showed a significantly lowerd (p<0.001) colonisation by the family Enterobacteriaceae in the ileum as compared to both the non-infected control and the infected control group. Collectively the data presented in Figure 2–3 suggest that ppIgG inhibits ileal/intestinal adhesion of bacteria from this family.