



2A-109: Assays to measure gut health in order to identify risk factors and control strategies for *E.coli* scours in weaner pigs

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Project Participants: NSW DPI and Nutreco

Aims and Objectives

- 1: Enumerate bacteria from seeded faeces using Nutreco culture techniques (ISO standards).
- 2: Develop quantitative PCR assays for specific bacterial groups (total *E.coli*, F4 ETEC, Enterobacteriaceae, Lactobacilli and *Clostridium perfringens*).
- 3: Compare numbers and ratios of commensal to pathogenic bacterial using bacterial culture techniques and qPCR.
- 4: Determine bacterial ratios in herds/pigs with and without *E.coli* disease.
- 5: Next generation sequencing and analysis of microbial community diversity in scouring and healthy pigs.

Key Findings

The new qPCR assays for enumeration of Enterobacteriaceae, Lactobacilli, *Clostridium perfringens* and *E.coli* in weaner pig faeces have proved to be an accurate alternative to the more time consuming enumeration by bacterial culture. The qPCR results correlated well with traditional bacterial culture techniques (ISO standards). The new assays also enabled testing of 100 samples in a day relative to the culture techniques that could only test 10 samples over 2 days, providing time and cost savings. Samples for qPCR could be frozen before transit to the lab without loss of accuracy, which is not possible with bacterial culture techniques.

No simple relationship between scouring and decreased ratios of commensal (Lactobacilli) to pathogenic bacteria (*E.coli*) was found over the 7 farms. On two farms scouring correlated well with increased pathogen load and decreased commensal load, but other factors appeared to be responsible for scouring on the other 5 farms. The increased abundance of Lactobacilli in scouring pigs has been reported previously and may be part of the host's response to disease.

Excitingly, we were able to identify other commensal bacteria that are less abundant in scouring pigs and these butyrate producing bacteria may provide a more accurate measure of gut health than the Lactobacilli. It would be fairly easy to develop qPCR assays for the 3 most important butyrate producing bacteria to monitor gut health and microbial stability.

The impact of antibiotics on bacterial populations was somewhat surprising with increased pathogen loads and decreased commensal bacteria in medicated pigs. Reduced abundance of protective commensal bacteria (including both lactate and butyrate producing bacteria) in medicated pigs could exacerbate disease in scouring weaners. However, further studies are needed to investigate the impact of specific antibiotics on both commensal and pathogenic bacteria.

Application to Industry

This project has developed some tools to monitor intestinal health in weaner pigs and has identified other bacteria important for intestinal health. These tools can be used to monitor the impact of dietary additives such as fatty acids, probiotics, prebiotics, organic acids, yeasts, zinc and copper, essential oils and antibiotics on scouring in post-weaner pigs.

The ultimate application of this research is to develop tools to evaluate alternatives to antibiotics for the control of post-weaning scours and we have achieved this. The qPCR assays can also be used to evaluate the impact of management practices on post-weaning diarrhoea, such as genetics, disinfection, cross-fostering gilt and sow litters, mixing of pigs, housing and temperature control.