Porcine proliferative enteropathy – an update on prevalence, problems, prevention

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Lawsonia intracellularis, the bacteria that causes porcine proliferative enteropathy, also known as porcine Ileitis, reduces animal wellbeing, contributes towards an increased use of antimicrobials and causes significant economic losses on intensive pig-production systems worldwide.

This obligate intracellular, gram-negative bacterium is ubiquitous and highly pathogenic even at low doses. Excretion in pig faeces for up to 14 weeks, with a survival time of two weeks in the environment and with rodents representing an important reservoir, may explain the difficulty associated with eradication attempts.[1, 2]

Besides pigs, *L. intracellularis* has become increasingly prevalent in young horses, rabbits, hamsters and other species including non-human primates. However, the location of lesions, clinical signs and genomic patterns are host specific. The profound hypoalbuminemia associated with young affected horses is not a feature of pigs.[3] Pigs present at approximately two to three months of age, mainly as a sub-clinical disease, following predisposing factors such as mixing, large group size, diet change and a decline in *L. intracellularis*-specific colostral antibodies.[1,3]

HIGH PREVALENCE

L. intracellularis is widespread in pig herds in Ireland. A recent *L. intracellularis* prevalence study using quantitative polymerase chain reaction (qPCR) and ELISA testing in six European countries, including the UK, has shown a 100% herd prevalence. The within-herd prevalence was between 20-51% depending on the age of pigs at testing.[1] This fact is significant. Testing close to antibiotic and zinc sulphate treatment yields lower than expected positive results on qPCR.[1]

PATHOLOGY

Ileitis is characterised by thickening of the lower ileum and sometimes large intestinal mucosa due to replacement of the epithelium of intestinal villi and crypts with proliferative immature epithelial cells with a clear demarcation on histopathology. Lesions range from small patches of sub-serosal oedema to confluent lesions with a nodular and folded surface and without pathology in local lymph nodes.[4] Absorption of nutrients is impeded and secondary infections eg. *Salmonella* may be more frequently observed.[5]

Figure 1: Thickening and corrugation in the ileum.

LOSSES

Significant losses such as reduced average daily weight gain (ADG), increased feed conversion ratio (FCR), variation in batch sizes and, occasionally, mortality have been reported with and without diarrhoea.[1] More commonly, sub-clinical infection may occur without the clinical signs of infection, but still result in reduced growth performance. Losses vary from country to country and in the UK, Ileitis was reported to cause losses between £2 million and £4 million per year.[6]

The dose of bacteria ingested by pigs will determine disease severity, as well as the pigs' diet, genetics, immune response, including maternal antibody presence, intestinal microflora and general health and stress.[3] Levels of *L. intracellularis* infection on qPCR in several studies, both field and experimental, correlated clearly with ADG reduction.[7,8]

DIAGNOSIS

L. intracellularis is very difficult to grow *in-vitro* except on specific atmosphere cell culture media so antibiotic sensitivity testing is limited.[9] The detection of the bacterium is based either on staining methods in tissue samples or PCR on faecal samples.[2,9] There is a good correlation between the severity of histological lesions in the ileum and the concentration of genome equivalents of *L. intracellularis* in faeces detected by qPCR.[7] As the clinical impact, measured by reduced ADG, is correlated with the frequency of detecting *L. intracellularis* in faeces by qPCR, this is the diagnostic method of choice for Ileitis in Europe.[1] This test provides useful information to institute optimal disease control measures, including rational use of antibiotics, feed improvements, biosecurity, hygiene and vaccination programmes.[1]

A post-infection field study showed qPCR levels were highest eight weeks post weaning with a rapid decline in the following two weeks, whereas serological positivity increased from eight weeks of age following *L. intracellularis* infection until 22 weeks.[8] Sock samples tested by qPCR for diarrhoea pathogens were as reliable a diagnostic method in weaner pigs as individual pooled samples and are a practical testing method in these COVID-19 lockdown days.[10]

A positive result on faecal PCR means bacterial DNA is

Figure 2: Boot covers suitable for PCR testing.

present but further diagnostic tests are required to establish the association of *L. intracellularis* with the differentials for Ileitis presentation such as brachyspiral colitis, salmonellosis, colibacillosis, PCV2 diarrhoea and hypersensitivity to soya beans.[9] The detection of specific antibodies in serum samples of fattening pigs by ELISA testing can help determine the presence and time of infection. This test should not be used for confirmation of Ileitis as it only indicates previous exposure to the pathogen.[1]

TREATMENT AND CONTROL

Acutely diseased animals require treatment with antimicrobials such as macrolides and tetracyclines. But while the goal of antibiotic treatment is the elimination of infective bacteria, antimicrobial treatment is often too late to prevent the low-grade intestinal crypt damage that is responsible for the economic losses of sub-clinical Ileitis. If antibiotics are used for prophylaxis, they need to be initiated prior to the onset of clinical disease.[9] In addition, in view of the prudent use of antimicrobials and the threat of antimicrobial resistance, the long-term strategy for controlling Ileitis should be based on prevention, through farm-specific vaccination programmes, biosecurity and the reduction of risk factors.[1]

BIOSECURITY AND CULLING

There have been some attempts at Ileitis eradication, mainly in Europe, based on medication and culling. While initial results showed improvement in growth performance and reduction in antimicrobial usage, in every eradication attempt, the herd was re-infected within two years.[4] Since then, there have been several advances in our understanding of Ileitis epidemiology, such as the role of mice as biological vectors.[11]

VACCINATION

There are two licenced vaccines against *L. intracellularis* in Ireland. One oral live, attenuated vaccine and a new inactivated vaccine for intramuscular use that can be combined with other piglet vaccines in the farrowing house. Vaccination is highly efficacious in reducing the risk of infection and results in marked improvements in fattener performance.[8] In addition, several studies have shown that *Salmonella typhimurium* prevalence and shedding is decreased following *L. intracellularis* vaccination in co-infected pigs through a presently unidentified effect on the gut microbiome.[5]

Ileitis remains an important and complex disease, but with more specific and targeted diagnostic tests and the availability of vaccines for Ileitis control, there is hope for a brighter future ahead.

References available on request.