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Management of ileitis of high health farms

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Introduction

Much has been learned about treatment regimes with PPE (porcine proliferative enteropathy or ileitis) challenge models in recent years. However, very little is known regarding the epidemiology or pathogenesis of the disease. Currently, both the chronic and acute forms of ileitis are widely controlled through the use of feed-grade antibiotics. However, antibiotic treatment "failures" are quite common, especially with the acute PHE (porcine hemorrhagic enteropathy) form. This paper will review the most common reasons for treatment failures and expound upon non-antibiotic methods of management and control for ileitis.

Unique characteristics of Lawsonia intracellularis

Lawsonia intracellularis (LI) is a non-spore forming, flagellated, micro-aerophilic, obligate intracellular, gram-negative curved bacillus (rod)[1].

The bacteria grow only on tissue cell lines at oxygen and CO_2 concentrations that mimic the small intestine.

It has a relatively long incubation period of 7–21 days. This, however, is dose-dependent and clinical signs of diarrhea occur as early as 5 days, with gross proliferative lesions occurring as early as 14 days in experimental challenge studies [2].

LI has a long duration of intermittent fecal shedding starting about 7–14 days post experimental challenge and lasting for at least 10 weeks[3].

Disease prevalence

A recent survey of US swine practitioners indicated ileitis to be the most important enteric disease of grow-finish swine. It is considered ubiquitous. Serological herd prevalence is 96% out of 196 US farms[4].

The acute hemorrhagic PHE form continues to be a particular problem in "high-health" herds in the finishing stage, in swine genetic company farms, and in young breeding stock in newly repopulated herds. Outbreaks are difficult to predict, difficult to treat or control, and costly to the producer.

Chronic ileitis in the grower pig is still the most prevalent form of the disease. It seems to be relatively stable in prevalence. This is likely due to the use of prevention and control feed grade antibiotics, sanitation, internal biosecurity, and all-in—all-out systems.

The extent of the inapparent or subclinical form of the disease is unknown. Even though fecal PCR analysis and *Lawsonia intracellularis* serology are now available to the practitioner, neither is reliably able to detect carrier pigs or herds[5]. It is considered common, but the exact prevalence of the subclinical form is unknown.

Transmission

Lawsonia is transmitted via the fecal-oral route. Horizontal (lateral) transmission from pig to pig is the most common. The organism can live in a pit for at least one week and re-infect pigs via pit slurry[6]. It is also likely that dirty boots, transport vehicles, and anything coming in contact with contaminated manure can transmit LI infection.

Vertical transmission from shedding sows to suckling pigs is also hypothesized but not yet proved.

Even though lesions of PE have been reported in a rat, the disease cannot be reproduced in mice[7]. Therefore, rodents are not considered vectors in disease transmission.

How is ileitis managed in practice?

Both the chronic and acute forms of ileitis are widely controlled by feed grade antibiotics such as tylosin, lincomycin, chlortetracycline, carbodox, and tiamulin (see **Table 1**).

Eradication attempts with common MMEW programs that weaned pigs less than 10 days of age have not been successful[6].

Once the disease is known to be present on the farm, strategic in-feed medication prevention/control programs are usually implemented.

Figure 1 shows an example of a population of variable diseased pigs. The objective is to control the level of dis-

Table 1. Currently available feed grade antibiotics in the US with known ileitis effectiveness

Antibiotic	Level	Duration
Tylosin*	100g/ton	21 Days
Lincomycin	40-100 g/ton	21 Days
Chlortetracycline	500 g/ton	14 Days
Carbodox	25-50 g/ton	14-28 Days
Tiamulin	35 g/ton	21 Days

*Tylan is currently the only FDA approved antibiotic for ileitis.

ease severity through management and antibiotic control programs. If a severe outbreak does occur, water medications and individual injectable antibiotics are generally necessary, especially in the case of PHE.

Antibiotic "failures"

There are many reported ileitis treatment failures with feed medication. Some reasons for these failures are listed here from most likely to least likely.

Reduced feed intake (ADFI)

Reduced feed intake and subsequent reduced average daily gain (ADG) are common clinical signs of ileitis, as shown in Figure 2 and Figure 3, respectively. Reduced ADFI causes subtherapeutic antibiotic intake and therefore reduced effective control or treatments of the disease.

Figure 2 indicates a dramatic reduction in ADFI in the positive (LI-challenged) control group 14–28 days after challenge in an ileitis trial. Similarly, average daily gain drops dramatically in the positive controls due to reduced feed intake in **Figure 3**. The feed antibiotic treatment significantly improved ADFI and ADG in weeks 3 and 4, yet is still quite adversely affected by the LI challenge when compared to the negative, unchallenged controls. Adequate feed antibiotic intake would not be possible if given at this time because it would be implemented too late in the course of the disease.

Management stressors

Five specific risk factors have been statistically proven to predispose pigs to ileitis outbreaks. They are co-mingling, overheating/chilling, transportation, repopulation, and new buildings[7].

Ileitis episodes typically occur 2 weeks (1–3 weeks) after one or more of these stresses. Anything managers can do to reduce them will likely minimize clinical signs.

Figure 1. PPE status/medication protocol

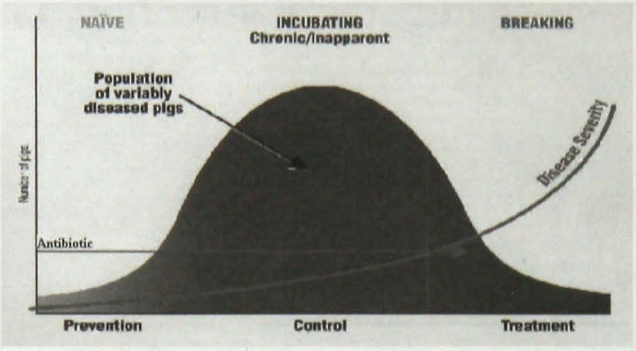


Figure 2. ADFI per week by treatment

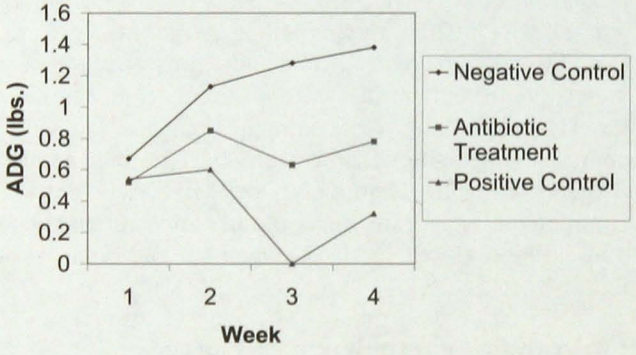
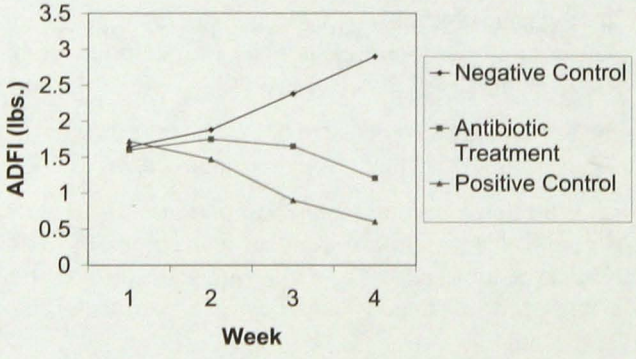


Figure 3. ADG per week by treatment



Timing of treatment

To be most effective, feed grade antibiotics need to be given *prior to* clinical signs due to the ADFI problem, rather than given after clinical signs appear.

Inaccurate diagnosis or concurrent infections

An accurate diagnosis can be challenging with non-bloody grower pig diarrhea associated with the chronic form of ileitis. Inaccurate diagnosis can cause ineffective control programs. For example, concurrent *Brachyspira pilosicoli* and *Lawsonia* infection would warrant lincomycin, tiamulin, or carbodox rather than tylosin or tetracycline prevention or control programs.

Wrong method of treatment

In acute PHE outbreaks, water medication and individual injections are more effective than treating ileitis through the feed.

Inadequate antibiotic dose level in the feed

Below-therapeutic antibiotic levels for disease control are often purposefully added to the feed, only to result in inadequate disease control. For example, 40g/ton tylosin is often used without success, even though the label claim it is only to be used at "100g/ton for 21 days for the prevention and control of ileitis."

Noncompliance: Antibiotic mixing errors

In some cases, antibiotic failure is simply due to human error at the feedmill by not adding the correct amount of antibiotic, inadequate mixing times, etc. This results in sub-therapeutic levels in the feed.

Antibiotic resistance

It is unlikely that *Lawsonia intracellularis* develop antibiotic resistance. Studies on *Lawsonia* and other obligate intracellular bacteria indicated that strains from difference locations have similar minimal inhibitory concentrations (MICs). Also, longitudinal analysis of studies of the MICs of chlortetracycline and of macrolides (such as tylosin) for *Lawsonia sp* isolates grown from tissues infected in the early 1980s and in the late 1990s indicated no reduction in susceptibility. Lastly, *Lawsonia Sp* have shown no evidence of possessing plasmids nor of possessing stable extracellular forms. The various antibiotic resistant genes frequently carried on plasmids may therefore be unavailable to the bacteria[8].

Other management practices to reduce transmission

Double footbath protocol

Ammonium chloride and iodine disinfectants are effective against *Lawsonia intracellularis*[4]. Two footbaths at the entry to barns are recommended: first, a phenol-based disinfectant which tolerates organic matter, then a final ammonium chloride footbath that targets specific agents such as LI[6].

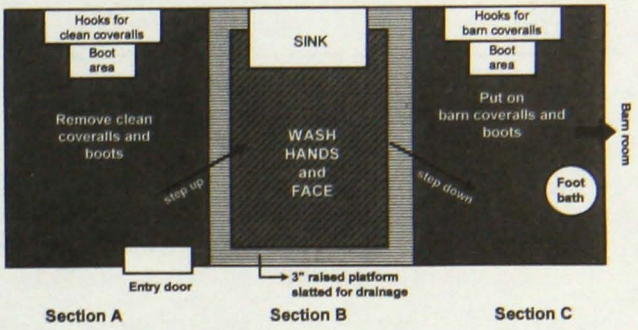
Biosecure Danish entry

Figure 4 is an example of the recommended entry into multiple finishing barns on a site. A distinct "clean zone" for boots and coverall removal is well demarcated by a raised slatted platform from the "dirty zone" containing barn boots and coveralls. This simple process can become habitual upon entry and will reduce horizontal transmission of enteric pathogens between barns.

Water medicate by pen, not by room/building

Medication cost savings can occur when medication lines are set up to medicate individual pens rather than an entire finishing building. PHE often occurs randomly in different pens in sporadic pigs throughout a large finishing barn. Producers would then have the option to separate individual sick pigs into hospital pens to water medicate or leave them in the same pen.

Figure 4. Layout of finishing barn changing area and protocol



Nutritional feed additives and nutriceuticals

There are at least two non-antibiotic feed additives used in ileitis field cases that show promise in aiding in its control: mannon oligosaucharides (Mos) and a nutriceutical combination product. Currently there is no scientific research to validate their effectiveness.

Mannon oligosarchardies are derived from the cell wall of yeast. They have a two-fold activity of absorption of enteric pathogens (*E. coli, Salmonella spp*) and immunomodulation. The mode of action is to bind to lectins of pili, fimbria, or flagella of bacteria[10]. Since *Lawsonia intracellularis* have a flagella it is hypothesized that Mos may exhibit a direct effect by binding to the bacteria reducing intracellular invasion.

An example of a Mos (Bio-Mos7 Alltech Inc) and antibiotic pulse medication program that has shown promise in controlling acute PHE and *Brachyspira pilosicoli* concurrent infection in the grow-finish is as follows[12]:

Step 1: Tiamulin 35 g/ton—2 weeks
Step 2: Mos 2 lb/ton—6 weeks
Step 3: Tiamulin 35 g/ton—2 weeks
Step 4: Mos 1 lb/ton—6 weeks

Ileitis vaccines

Ileitis is ubiquitous and no herds are considered completely "free" of the disease. Since ileitis affects both the growing and finishing pigs, as well as young breeding stock, effective vaccines would potentially be widely used by the industry. These vaccines need to be cost effective and efficacious in preventing the performance loss of chronic ileitis and the mortality associated with acute PHE.

Currently, promising research and development of such vaccine products are on-going. Pigs previously exposed to LI are resistant to re-challange four weeks later. Recently a conditional license for PPE vaccine has been

granted. Information regarding two vaccine challenge studies are being reported at this Leman Conference[13].

Summary

Although use of feed-grade antibiotics is the most common method of ileitis prevention and control, there are still many reported failures in the face of antibiotics. Reducing specific environmental stressors, practicing good biosecurity, and using water medications and injectable antibiotics in severe outbreaks are all important methods to manage ileitis in high health herds.

Recently, studies incorporating non-antibiotic feed additives and vaccines for control of ileitis have been initiated. Preliminary results suggest that they may also be effective means of prevention and control.

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