Exploring Emerging PathKinex Trends

Together United Animal Health and Microbial Discovery Group are pioneering the investigation of relationships between microbial virulence genes and animal health. Our PathKinex™ platform and growing database of rectal and intestinal swab samples provide a unique resource for identifying and exploring connections between microorganisms and host or environmental factors, and we are eager to share our key findings with you!

ProVent® ECL associated with lower quantities *E. coli* virulence genes

Pathkinex™ Updates are intended to provide you with the latest research insights on emerging pathogen trends and are for your internal use.

In this update, we explore the use of ProVent® ECL in sow farms and nurseries as a tool for managing virulent *E. coli*. First, we examine how feeding ProVent® ECL to sows can improve progeny outcomes when managing pathogenic *E. coli* through an evaluation of six sow farms before and after implementing ProVent® ECL. Next, we examine the potential for *E. coli* control during the critical nursery stage through surveillance comparisons of nurseries with or without ProVent® ECL.

Role of *E. coli* in neonatal and postweaning diarrhea

E. coli is often one of the primary pathogens associated with neonatal and post-weaning diarrhea, costing the swine industry hundreds of millions of dollars annually from increased mortality, morbidity, treatment expenses and lost performance (1, 2). Commensal *E. coli*, residing in the animal without causing harm, are one of the most abundant occupants of the mucosal layer of the swine intestine. Within this protective mucosal layer of the intestine, microorganisms compete for available nutrients, including different pathogenic *E. coli* "pathotypes". Highly competitive pathotypes, enterotoxigenic (ETEC) and enteropathogenic (EPEC) *E. coli* are commonly associated with disease, producing outbreaks that frequently affect a high proportion of pigs and are often recurrent in the same herds.

These pathotypes harbor combinations of virulence genes which enable them to cause disease. Virulence genes associated with fimbriae and other adhesins promote adherence to the intestinal mucosa and genes responsible for harmful toxin and hemolysin production act on the intestinal epithelial cells to induce the secretion of water and electrolytes into the intestinal lumen, causing the clinical signs of diarrhea.

Additional stressors on the animal may increase susceptibility to disease associated with *E. coli*. For example, weaning, environmental stress or the presence of other bacterial or fungal pathogens, parasites, or mycotoxins, can allow *E. coli* to exploit compromised conditions in the intestine and further proliferate.

Pathkinex Method: Detect>Quantify>Correlate

For this analysis, rectal swabs were obtained from 6 commercial sow farms before (64 sows, 136 piglets) and approximately 4 months after (68 sows, 121 piglets) implementation of ProVent® ECL. In the nursery analysis, rectal swabs were compared from pigs at 10 commercial nurseries receiving ProVent® ECL (148 pigs, avg 7.6 days post-wean) to swabs from pigs at 20 nurseries without ProVent® ECL (410 pigs, avg 8.7 days post-wean). DNA and RNA were extracted from all swabs and analyzed using our proprietary Pathkinex method to determine quantitative differences in virulence genes by treatment. (Figure 1).

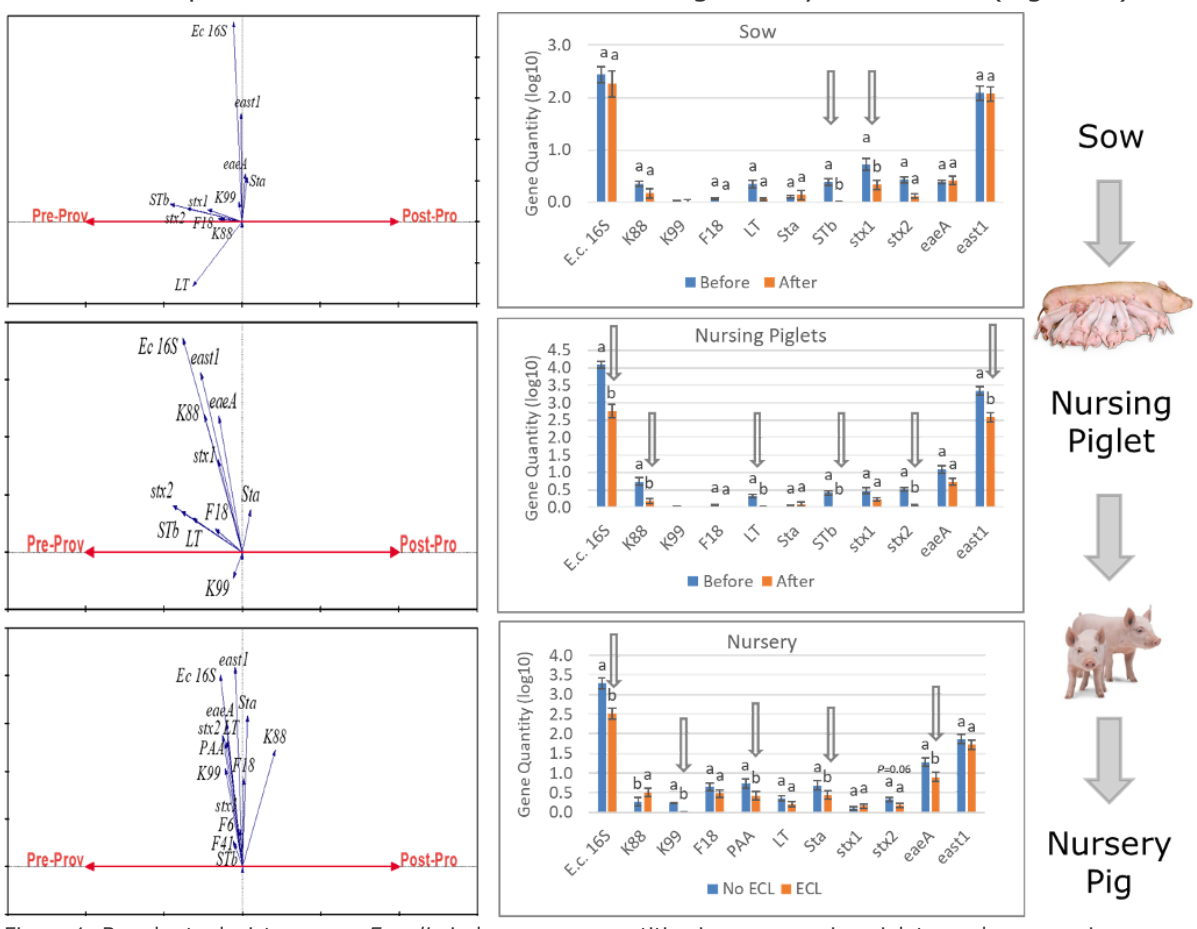

Figure 1. Bar charts depict average *E. coli* virulence gene quantities in sows, nursing piglets, and nursery pigs supplemented with or without Provent® ECL. Statistical ordination graphs provide an overview of the relationship between virulence gene abundance and treatment. Different superscripts indicate means differ P<0.05. *One nursery site experienced a break with K88+ *E. coli*, prompting sampling.

Findings

- **Multiple *E. coli* virulence genes were reduced in sows fed ProVent® ECL and their suckling progeny**
  - In sows: Reduced *STb*, associated with heat stable enterotoxin production and *Stx1,* associated with shigatoxigenic *E. coli*
  - In piglets: Reduced total *E. coli*, fimbrial adhesin *K88*, and toxin genes found in enterotoxigenic, enteroaggregative and shigatoxigenic *E. coli* (*LT*, *STb*, *Stx2* and *EAST1)* by feeding Provent® ECL to the sow
- **Nursery pigs consuming ProVent® ECL harbored reduced quantities of *E. coli* virulence genes.**
  - Reduced total *E. coli*, fimbrial adhesin *K99*, intestinal attachment genes (*PAA*, *eaeA*) and heat stable enterotoxin gene (*STa)*

Action

These PathKinex™ findings suggest that ProVent® ECL along side interventions such as modern vaccine strategies, sanitation, and good management practices, can support gut integrity and help manage virulent *E. coli* in the GI tract. Supplementing the sow provides an excellent opportunity to proactively manage enteric health in the young piglet and administration in the nursery can further support a healthy microbiota during this critical period.

Discussion Question

What interventions are your customers most frequently utilizing for management of virulent *E. coli* on their farms?

Are you seeing the same trends in the field?

Respond to MDG

Is there a topic you'd like to learn more about in a future newsletter? We enjoy hearing from you! We welcome your questions, comments and suggestions on PathKinex updates. Please contact us at AnimalAg@mdgbio.com

References

Fairbrother JM, Gyles CL. Colibacillosis. In: Zimmerman JJ, Karriker LA, Ramirez A, Schwartz KJ, Stevenson GW, editors. Disease of Swine. 10th ed; 2012. p. 723–47.

Sjölund M, Zoric M, Wallgren P. Financial impact on pig production: III. Gastrointestinal disorders: Proceedings of the 6th European Symposium of Porcine Health Management, Sorrento; 2014. p. 189–Italy.