

***E. coli* associated post-weaning diarrhea: Evolution of an old disease**

Post-weaning diarrhea (PWD)

E. coli is a major part of the commensal intestinal microflora of pigs but some *E. coli* strains can cause disease. PWD is considered to be an “old” disease, so veterinarians and producers are accustomed to it always being present in the “background”. On the other hand, this disease is constantly in evolution, acute crises giving place to calm years, and vice versa. These fluctuations are due to different factors such as management changes, appearance or eradication of coexisting diseases, adaptation of the causative *E. coli*, etc.

Typically, PWD manifests as severe watery diarrhea during the 2 first weeks post-weaning, dehydration, and/or mortality. Sudden death of pigs without apparent clinical signs is often observed. Economic losses associated with PWD are significant, due to mortality, weight loss, weight heterogeneity of pigs, treatment costs, coexisting diseases, and management of sick animals.

Types of *E. coli* causing PWD

E. coli associated with PWD are mainly enterotoxigenic (ETEC). These strains harbour one or several of the enterotoxins LT, STa, and STb, which induce the diarrhea, and an attachment factor, such as the fimbriae F4 (K88) or F18 (F107), mediating the attachment of the bacteria to the intestinal mucosa. F4-positive ETEC are the main cause of PWD, worldwide. The most common serogroup is O149.

New clones of *E. coli* associated with PWD

PWD crises have been increasingly reported since the 90's in Canada, being associated with new clones of F4-positive ETEC. These new strains, now predominant in Canada, are more virulent and more resistant to antimicrobials. Retrospective studies have shown that the virotype F4:LT:STb was predominant before 1990 (Fairbrother et al., 2000; Fontaine et al., 2002; Noamani et al., 2003) but that the virotype LT:STa:STb became as prevalent as (Fairbrother et al., 2000; Fontaine et al., 2002) or more prevalent than (Noamani et al., 2003) the older virotype after 1990.

Treatment and antimicrobial resistance

Antimicrobials, such as apramycin, neomycin, and trim-sulfa, are frequently used on farms to treat PWD (Amezcuca et al., 2002). In recent years, emergence of resistance to these antimicrobials

has been observed for PWD associated *E. coli* strains (Fairbrother et al., 2000; Maynard et al., 2003). A dramatic increase of multiresistance and ceftiofur resistance has been recently observed for PWD associated ETEC (Fairbrother J.M., personal communication). A study carried out at the EcL laboratory (Faculty of veterinary medicine, Saint-Hyacinthe) revealed that the use of antimicrobials to treat PWD promotes antimicrobial resistance, not only for pathogenic *E. coli* strains but also for commensal *E. coli*. There is thus growing concern about the increasing pool of drug-resistance genes in bacteria in the pig intestine.

F4-positive ETEC – One cause – Variable disease patterns

PWD disease patterns tend to change over time due to the appearance of new coexisting diseases, new production management strategies, new pathogenic *E. coli* strains, etc. Improvement of feeds and of biosecurity in recent years has minimized PWD crises on some farms but it is still common to observe severe cases on other farms. Today, it is not rare to isolate F4-positive ETEC strains in the 2 first weeks post-weaning from less aggressive cases. PWD is now also observed later in the nursery phase and at the beginning of the growing phase. Although these cases may be associated with lower levels of mortality, losses may be substantial due to lowered performance, high treatment costs, handling of sick older animals, and selection of antimicrobial resistant *E. coli* strains. Finally, mortality and/or diarrhea associated with F4-positive ETEC are also observed in the maternity, mainly in nursing pigs during the last week of lactation.

Diagnosis of PWD

The diagnosis of classic cases of PWD is generally straightforward, clinical signs being easily identifiable and the causative strain is excreted in the feces of affected pigs. The isolation of the causative strain and the identification of virulence factors confirm the case. Cases associated with mild diarrhea and low mortality rate, but nevertheless with lowered production performance, or cases observed outside the classical susceptibility window (2 first weeks after weaning) are often not diagnosed or misdiagnosed. Detection or isolation of F4-positive ETEC can be easily done on fecal samples for these cases.

Coliprotec: An effective new approach for an old disease

Description

Coliprotec is an oral live vaccine recommended for the vaccination of healthy weaned pigs of 17 days of age or more, as an aid in the prevention of PWD caused by F4-positive ETEC. Clinical studies confirmed that the administration of ONE DOSE of Coliprotec via the drinking water significantly reduced intestinal colonization of virulent ETEC, diarrhea, and accumulation of fluid in the intestines after a challenge.

Administration

The Coliprotec is administered orally using ONE DOSE per pig. Three methods of administration are recommended, being 1) Individual oral administration using a syringe, 2) Conventional drinking water systems and 3) Automatic medicator (proportioner) watering system. Material used for the administration of the vaccine must be free of antibiotic or disinfectant residue, to prevent inactivation. It is recommended that antibiotics or other live oral vaccines not be used for a minimum of 3 days prior to and after vaccination. However, Coliprotec may be used simultaneously with some antibiotics. Please contact the Prevtec microbia technical support for more information regarding compatible antibiotics for Coliprotec administration.

Advantages and benefits

A single dose of Coliprotec stimulates an intestinal immune response to prevent PWD. The vaccine is administered in the drinking water, without restraint or injection of pigs. Coliprotec is lyophilized, thus stable and can be stored in a standard refrigerator at the clinic or on the farm.

Safety

The safety of the Coliprotec vaccine in farm conditions was confirmed in a field safety study carried out in Manitoba, Ontario, and Quebec on a total of 753 vaccinated pigs. No undesirable side effect of Coliprotec was observed and pigs were in good health during and following the vaccination. The safety of Coliprotec was also demonstrated in several controlled experimental studies. The production process of the Coliprotec vaccine is exempt of any animal product, animal by-product, or animal cell lines.

Efficacy

Controlled study

A controlled study using 20 vaccinated and 20 unvaccinated pigs confirmed that the administration of a single dose of Coliprotec to 17-day old weaned pigs significantly reduced 1) the intestinal colonization by ETEC causing PWD, 2) the number of pigs excreting ETEC strains causing PWD, 3) the prevalence, the duration and the severity of diarrhea, 4) the prevalence, the extent and the severity of intestinal accumulation of fluid, and 5) production performance losses.

Field data

A study was carried out on a farm with mild to moderate PWD problems on a total of 2365 vaccinated and 2339 unvaccinated pigs. We observed a lower mortality rate, a higher daily weight gain, and a better feed conversion for the vaccinated group as compared to the unvaccinated group (table 2).

Table 1: Controlled efficacy study of Coliprotec

	Vaccinated	Unvaccinated
Pigs excreting ETEC strain 3 days after challenge (%)	25	100
Duration of diarrhea (days)	0.0	1.0
Severity of diarrhea (score)	1.5	3.5
Extent of intestinal accumulation of fluid (score)	0.5	2.5
Severity of intestinal accumulation of fluid (score)	2.0	6.5
Daily weight gain after the challenge (gram/day)	410	308

Table 2 : Efficacy data for the Coliprotec vaccine on farm

	Vaccinated	Unvaccinated
Mortality (%)	1.57	2.34
Daily weight gain (gram/day)	444	418
Feed conversion	1.31	1.41
Antimicrobial treatment	No	Trim/sulfa (3 periods of 3 days)