

# Novel Vaccine Reduces Prevalence and Shedding of *Escherichia coli* O157:H7 in Cattle

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## Introduction

*Escherichia coli* O157:H7 is a food-borne pathogen that causes severe hemorrhagic colitis and hemolytic uremic syndrome (HUS) in humans. The gastrointestinal tract of cattle is the main reservoir for *E. coli* O157:H7, making cattle feces a possible direct and indirect source of exposure for humans. According to the CDC, shiga-toxin producing *E. coli* O157 causes an estimated 73,000 illnesses annually in the United States, resulting in over 2,000 hospitalizations and 60 deaths (Frenzen et. al, 2005). Interventions used to reduce shedding of this microorganism will lower contamination of the environment. A recently developed vaccine that targets Gram-negative bacteria's ability to acquire iron may be a practical intervention strategy for reducing the prevalence of this pathogenic microorganism. Therefore, the purpose of the study was to evaluate the efficacy of a vaccine containing outer membrane siderophore receptor and porin (SRP) proteins in reducing fecal prevalence and shedding of *E. coli* O157:H7 in cattle.

## Materials and Methods

Thirty, 3 to 4 month old calves were randomly assigned to one of two treatment groups and were subcutaneously administered either the placebo or the *E. coli* O157:H7 SRP vaccine on days 1 and 21. Calves were moved from a local Kansas farm to a BL-2 facility one week after the second vaccination was administered and were confined to individual pens. On day 36, calves were orally inoculated with a mixture of 5 strains of *E. coli* O157:H7 made resistant to nalidixic acid (NalR). Blood samples were collected weekly to monitor calves' anti-SRP antibody titers and fecal samples were collected

three times a week for the following 5 weeks to monitor fecal shedding of the NalR *E. coli* O157:H7. Five weeks post challenge, calves were euthanized and gut contents were collected to further evaluate the presence of the NalR *E. coli* O157:H7.

## Results

Both treatment groups had similar antibody titers prior to vaccination. Two weeks after the first vaccination was administered, the average number of anti-SRP antibodies in the SRP vaccinated animals was 34% higher than the number of anti-SRP antibodies present in the placebo vaccinated animals. Vaccination with the SRP *E. coli* O157:H7 vaccine decreased the number of cattle shedding *E. coli* O157:H7 in the feces ( $P = 0.03$ ) and there was a significantly ( $P = 0.04$ ) lower fecal concentration of NalR *E. coli* O157:H7 in the SRP vaccinated cattle when compared to the placebo group. Cattle vaccinated with the SRP *E. coli* O157:H7 vaccine had fewer samples positive for *E. coli* O157:H7 at necropsy when evaluating the cecum ( $P = 0.06$ ), colon ( $P = 0.05$ ), and rectum ( $P = 0.06$ ) compared to cattle administered the placebo.

## Significance

Overall, orally inoculated calves vaccinated with the SRP vaccine had a reduction in prevalence of *E. coli* O157:H7 when compared to calves vaccinated with a placebo. This not only defines a new potential pre/post-harvest intervention strategy for reducing food borne illness, but also helps to increase consumers' confidence when purchasing quality beef.