Passive Immunity of Neonatal Calves Given Colostrum Containing *E. coli* O157:H7 SRP Antibodies from an *E. coli* K99 Challenge

B.W. Wileman[1], *DVM;* **D.U. Thomson**[1], *PhD, DVM;* **D.T. Burkhardt**[2], *MS;* **L. Slinden**[2], *DVM;* **A.M. Schueler**[2], *BS;* **D.E. Straub**[2], *MS*
1College of Veterinary Medicine, Kansas State University, Manhattan, KS 66506
[2]Epitopix LLC, Willmar, MN 56201

Introduction

Epitopix LLC has the first license for an *E. coli* O157 vaccine in the USA that is based on use of siderophore receptors and porin proteins (SRP™) that are highly conserved across a large number of *Escherichia coli* isolates. Neonatal calf diarrhea is one of the leading causes of morbidity and mortality in calves. The most commonly described causative agents of acute neonatal diarrhea (scours) are *Escherichia coli*, coronavirus, rotavirus, and *Cryptosporidium*. *E. coli* strains of the K99 pilus type have been responsible for an estimated 25-30% of the scours related morbidity in calves during the first 3-4 days after birth, and approximately 30-50% of the scours-related mortality. Since the SRP antigens in the O157 vaccine are highly conserved among *E. coli* isolates, it is hypothesized that there may be a high degree of cross-protection to non-O157:H7 species of *E. coli*. The goal of this study is to examine the degree of cross-protection provided by colostrum containing a known amount of *E. coli* O157:H7 SRP antibodies against an oral challenge of *E. coli* K99 as evidenced by morbidity and mortality effects in neonatal colostrum deprived calves.

Materials and Methods

Prior to initiation of the study, heifers were vaccinated with *E. coli* O157:H7 SRP prior to parturition and the colostrum from these heifers was collected. The colostrum was pooled and placed into three quart aliquots (SRP colostrum). Colostrum was also collected from non-vaccinated heifers, pooled and placed in three quart aliquots (control colostrum). For blinding study personnel, the bags of colostrum were then labeled with only A or B, corresponding to dam vaccination. Neonatal, colostrum deprived bull calves (n=11) were procured from a dairy calving facility and transported to a climate controlled research facility. Calves were randomly assigned to one of two treatment groups, A or B. Calves were administered the *E. coli* challenge orally one hour after colostrum treatment administration. Serum blood samples were taken on calves daily (day 0-7) to measure *E. coli* O157:H7 SRP specific antibody titers. Calves were observed twice a day (day 0-7) and a hydration (1-3), fecal (1-4), respiratory (1-3), and an attitude score (1-4) was recorded. Data was statistically analyzed in STATA® using linear regression and ordered logistic regression models.

Results

A total of five calves died prior to study termination from causes unrelated to *E. coli* K99 challenge (three from SRP, two from controls). Colostrum treatment assignment had no significant effect on rectal temperature, attitude, respiratory, or hydration scores of calves ($P > 0.05$). Day of challenge was significantly predictive of rectal temperature, attitude, respiratory, and hydration scores of calves ($P < 0.05$). There were no significant day by colostrum treatment interactions for any of the predictors ($P > 0.05$). SRP colostrum treated calves had significantly improved fecal scores compared to control calves ($P = 0.05$). Colostrum treatment had no effect on fecal shedding of *E. coli* K99 by calves ($P > 0.05$). However, SRP colostrum treated calves had a 0.45 log CFU/mL lower concentration of *E. coli* K99 in feces ($P = 0.05$). Control colostrum calves had significantly lower serum *E. coli* O157:H7 SRP antibodies than SRP colostrum treated calves ($P < 0.001$).

Significance

This is the first report examining the cross-protection efficacy of colostral *E. coli* O157:H7 SRP specific antibodies to *E. coli* K99 challenge. This study demonstrated that there is some degree of cross-protection in terms of decreased fecal concentration of *E. coli* K99 and improved fecal consistency in challenged dairy calves. The loss of calves from unrelated causes was due to hypoxic and/or hypothermic complications, thus significantly limiting the power of this study. Further research into the cross-protective effects of *E. coli* O157:H7 SRP specific antibodies against pathogenic *E. coli* K99 strains is needed.