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Calf Note #119 – E coli shedding in calves fed milk replacer without and with antibiotics

Introduction

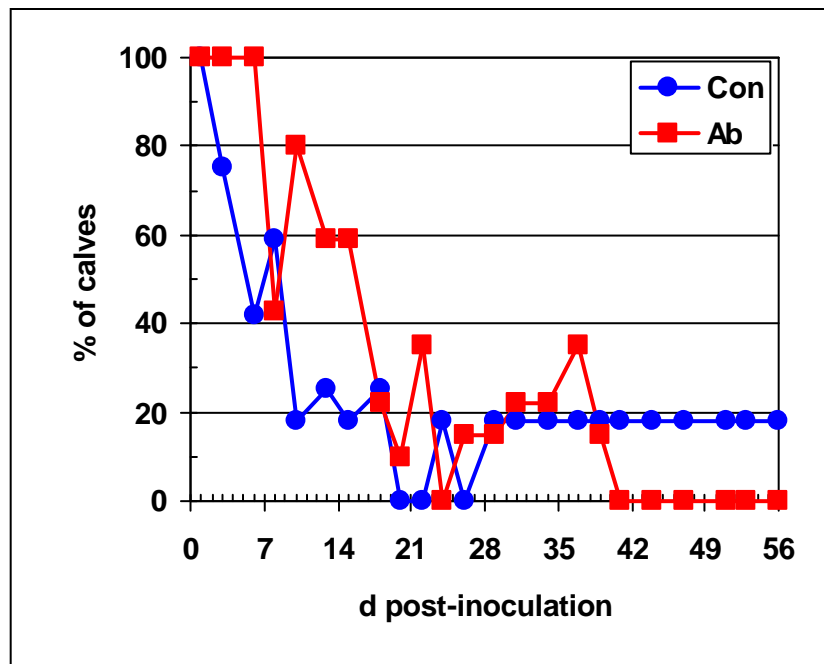
Pressure continues to build to eliminate the feeding of antibiotics in animal agriculture. Sub-therapeutic use of antibiotics (**Ab**) in animal diets usually increases growth and efficiency. They also have been reported to increase the risk of transmission of Ab resistance to pathogens of human importance, thereby making our current Ab ineffective. Universities, research institutes, and private firms are all searching for alternatives to Ab that can promote growth and efficiency with the same effectiveness but without the risks associated with Ab use.

In calf raising, milk replacers in some parts of the world are supplemented with Ab to reduce the effects of diarrhea prior to weaning. According to Heinrichs et al. (1995), more than half of all producers in the U.S. surveyed during the National Dairy Heifer Survey in 1991 used Ab containing milk replacers at least part of the time. While this number may have changed in the ensuing 10+ years since the study was conducted, undoubtedly, there is still significant medicated milk replacer being fed in the U.S.

An important question is whether this specific management practice contributes to the risk of Ab resistance in bacteria on the farm, and whether there is an increased risk to humans. To answer this question, researchers at Kansas State University (Alali et al., 2004) conducted a study to evaluate the effects of feeding milk replacer without or with Ab on the fecal shedding of *Escherichia coli* O157:H7 by calves. This strain of *E. coli* is a particularly nasty bug and has been associated with serious disease and deaths in humans.

Therefore, it is an excellent model for establishing the role of milk replacer containing Ab on important human pathogens.

In the study, 18 calves were housed in isolation with no calf to calf contact (important when you're working with a dangerous bacterium like *E. coli*). The calves were 1 week old when they started the study and were allowed two weeks to adjust to their new environment prior to starting the study. They were fed milk replacer to a maximum of 4 L/day, along with water, hay and non-medicated calf starter. The



milk replacers contained either no Ab or 200 mg/kg of oxytetracycline and 400 mg/kg of neomycin as neomycin sulfate. This represents a typical inclusion rate for milk replacers in the U.S.

After the two week acclimation, calves were orally inoculated with 3.6×10^8 cfu of *E. coli* O157:H7 mixed with the milk replacer (for you scientifically oriented readers, the *E. coli* was made resistant to nalidixic acid prior to inoculation for use as a marker).

Feces was collected three times per week from each calf until 8 weeks after inoculation to determine the number of calves shedding and, if possible, fecal counts shed. Then, calves were killed and samples taken from various sites in the digestive tract to determine whether *E. coli* were present.

The results of the study were very interesting. As can be seen in Figure 1, there was a lot of variation in the percent of calves that shed *E. coli* O157:H7 during the study. Actually, during days 6 and 10, more calves fed milk replacer containing Ab shed the *E. coli* than calves fed control milk replacer. This variation was also apparent in the amount of *E. coli* O157:H7 shed in feces (Figure 2) making it impossible to determine whether the Ab had an effect on shedding of the organism (i.e., no significant effect of treatment).

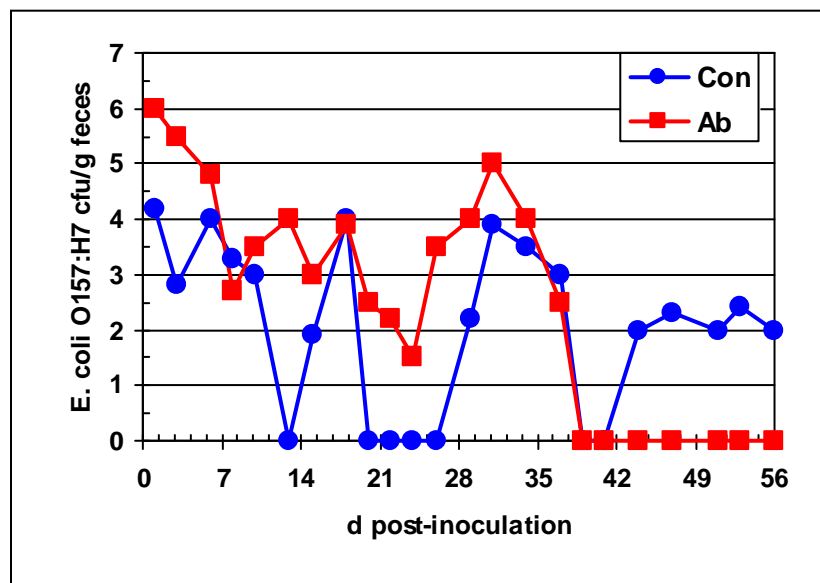
When calves were necropsied, three calves (one control, two Ab) had *E. coli* in various tissues.

The variability seen in Figures 1 and 2 suggests that including the Ab combination used in this study didn't markedly affect either the percentage of calves that shed *E. coli* O157:H7 or the amount excreted in the feces. When the researchers tested the bacterium, they found that it was resistant to both oxytetracycline and neomycin. They also hypothesized that this resistance is why more calves fed milk replacer containing Ab shed the *E. coli* early in the study. The theory is this – the *E. coli* O157:H7 used in the study was resistant to both oxytetracycline and neomycin. Many of the other bacteria in the calf's intestine are not resistant. Feeding the Ab might inhibit the growth of these other bacteria, thereby allowing greater growth of the *E. coli*. More *E. coli* means a greater percentage of the calves were identified as positive and a greater shedding of *E. coli* in the feces.

The authors pointed out that the strain of *E. coli* used in this study was a lab strain and there may be differences between the behavior of this strain and those seen on the farm.

Take Home Message

These data suggest that, when pathogens are resistant to the Ab commonly used in animal agriculture, the feeding of these Ab will have little effect on their growth in the intestine of animals.



When disease caused by bacterial infections is an important management challenge on your farm, it's important to talk with your veterinarian to establish which organisms are causing the problems and what Ab will work against that specific organism.

References

Alali, W. Q., J. M. Sargeant, T. G. Nagaraja, and B. M. DeBey. 1004. Effect of antibiotics in milk replacer on fecal shedding of *Escherichia coli* O157:H7 in calves. *J. Anim. Sci.* 2004. 82:2148–2152.

Heinrichs, A. J., S. J. Wells, and W. C. Losinger. 1995. A study of the use of milk replacers for dairy calves in the United States. *J Dairy Sci.* 78:2831-2837.

Written by Dr. Jim Quigley (10 November 2006)
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