Chapter 16

Is There a Connection Between Feeding DDGS and *E. coli* O157:H7 Shedding in Beef Cattle?

Introduction

Consumption of ground beef is the most frequently implicated cause of *E.coli* O157:H7 outbreaks in humans, and food products from cattle have been linked to approximately 75% of *E. coli* O157:H7 outbreaks (USDA-APHIS, 1997; Vugia et al., 2007). Cattle are a major reservoir of *E. coli* O157:H7. Due to repeated hemorrhagic colitis outbreaks in humans that are linked to the consumption of ground beef, as well as animal contact, manure management, or water runoff contaminated with cattle manure, the connection between cattle and *E. coli* O157:H7 has been firmly established both epidemiologically, and in public perception (Jay et al., 2007; Keen et al., 2007; Steinmuller et al., 2006).

Research results first published in 1998 showed that an abrupt shift from grain to hay-based rations significantly reduced generic *E.coli* populations (Diez-Gonzalez et al., 1998). These results generated several subsequent research studies that have yielded variable results (Hancock et al., 2000; Hovde et al., 1999; Keen et al., 1999). Callaway et al. (2008) published a thorough review of the current state of knowledge about the effects of diet and other cattle management factors on *E.coli* and O157:H7 populations. The focus of this chapter is to summarize research results related to feeding wet or dried distiller's grains with solubles on shedding of *E.coli* O157:H7.

Does Feeding DDGS Increase Shedding of E. coli O157:H7?

Bacteria are present everywhere in the environment and their presence in corn co-products does exist. The Center for Veterinary Medicine at the FDA conducted a survey of plant-derived protein animal feed ingredients in 2003, of which 79 samples were collected from a variety of oil-seed meals and cereal grain based products. Some of the samples showed presence of *Salmonella, E. coli, and/or Enterococcus* bacteria.[1]

Distillers grains were first shown to increase the shedding of *E. coli* O157:H7 in cow-calf operations in Scotland (Synge et al., 2003). In a subsequent study, other researchers found that feeding brewer's grains to cattle also increased *E. coli* O157 shedding, and increased the odds of shedding by more than 6-fold (Dewell et al., 2005). In 2007, there was a dramatic increase in interest in identifying and understanding the possible reasons for the increases in *E. coli* O157:H7 in ground beef contamination in the United States. Because of the exponential

[1] http://www.fda.gov/AnimalVeterinary/NewsEvents/FDAVeterinarianNewsletter/ucm095381.htm viewed 5-30-2012

increase in ethanol and distiller's grains production during this same time period, there were some suspicions that feeding distiller's grains were contributing to this problem. As a result, researchers began conducting studies to determine if there was a relationship between feeding distiller's grains with solubles and the increased incidence of E. coli O157:H7 in beef. A series of controversial studies conducted by researchers at Kansas State University (Jacob et al., 2008a,b,c), showed low prevalence and inconsistent responses to *E. coli* O157:H7 shedding in feedlot cattle fed distillers grains diets. Despite these inconsistent results, these researchers concluded that feeding distiller's grains increased fecal *E. coli* O157:H7 shedding in beef feedlot cattle.

Subsequent to the Kansas State University reports, researchers at the University of Nebraska (Peterson et al., 2007) fed up to 50 percent (DM basis) wet distiller's grains diets and showed that *E. coli* O157:H7 shedding occurred, but the level of shedding was no different than cattle fed diets containing no distillers grains. These results were not in agreement with those reported by Jacob et al. (2008a,b,c). Furthermore, Nagaraja et al. (2008) collected manure samples from 700 cattle fed either control and DDGS diets for 150 days and showed that the overall prevalence of *E. coli* O157:H7 shedding was low (5.1 percent) and feeding DDGS had no effect. The most recent study conducted by Jacob et al. (2009), showed no differences in fecal prevalence of *Escherichia coli* O157:H7 and *Salmonella* spp. in cattle fed dry-rolled corn or DDGS.

Currently, there is no scientific evidence suggesting that the levels of DDGS being fed is a cause for *E. coli* O157:H7 contamination in ground beef. Furthermore, if there is a possible connection between feeding of distiller's grains and E. coli shedding, the mechanism has not been elucidated. Some researchers have hypothesized that a possible connection may be due to intermediate end-products of yeast fermentation (e.g.vitamins, organic acids), but there has been no research conducted to confirm this. *In vitro* studies have not detected any effects of distiller's grains on *E. coli* O157:H7 populations in mixed ruminal and fecal fluid fermentations (Callaway et al., 2008). It is important to recognize that bacterial contamination (including *E. coli* O157:H7) in the meat supply can occur during many segments of the food chain, and is not restricted to feed or feed ingredients.

Conclusions

Food-borne pathogenic bacteria continue to be a significant threat to human health in many countries around the world, despite the implementation of food safety regulations. Although post-harvest sanitation strategies have reduced *E. coli* O157:H7 presence in meat products, implementation of pre-harvest intervention strategies can further reduce the risk of food borne pathogens in food animals before they enter the food chain. Some feedstuffs appear to alter shedding levels of *E. coli* O157:H7, but these effects have not always been consistent. Fasting and feeding poor quality forages have been shown to increase shedding of *E. coli* O157:H7 in cattle, but abruptly switching cattle from a high grain diet to a high-quality hay-based diet has been shown to reduce *E. coli* O157:H7 populations. More research is needed to identify the mechanism (e.g., competitive exclusion, physical removal, forage quality, tannins, lignin, other phenolics) by which feeding forage impacts the microbial populations of the ruminant intestinal tract, including the ecology of *E. coli* and *E. coli* O157:H7 populations, in order to implement practical dietary modifications.

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