

University of Nebraska - Lincoln

DigitalCommons@University of Nebraska - Lincoln

Nebraska Beef Cattle Reports

Animal Science Department

2009

Feeding Distillers Grains and *E. coli* O157:H7

Terry J. Klopfenstein

University of Nebraska-Lincoln, tklopfenstein1@unl.edu

David R. Smith

University of Nebraska-Lincoln, dsmith@cvm.msstate.edu

Galen E. Erickson

University of Nebraska-Lincoln, gerickson4@unl.edu

Rodney A. Moxley

University of Nebraska-Lincoln, rmoxley1@unl.edu

Follow this and additional works at: <https://digitalcommons.unl.edu/animalscinbcr>



Part of the [Animal Sciences Commons](#)

Klopfenstein, Terry J.; Smith, David R.; Erickson, Galen E.; and Moxley, Rodney A., "Feeding Distillers Grains and *E. coli* O157:H7" (2009). *Nebraska Beef Cattle Reports*. 529.

<https://digitalcommons.unl.edu/animalscinbcr/529>

This Article is brought to you for free and open access by the Animal Science Department at DigitalCommons@University of Nebraska - Lincoln. It has been accepted for inclusion in Nebraska Beef Cattle Reports by an authorized administrator of DigitalCommons@University of Nebraska - Lincoln.

Feeding Distillers Grains and *E. coli* O157:H7

Terry J. Klopfenstein
David R. Smith
Galen E. Erickson
Rodney A. Moxley1

Summary

The diet of feedlot cattle may affect the bacterial population in the hindgut, including E. coli O157:H7. Some research studies have shown a relationship between feeding of distillers grains and E. coli O157:H7 shedding. However, other studies do not show the same relationship. Our evaluation of research indicates feeding distillers grains is not related to 2007 ground beef recalls. Furthermore, interventions such as vaccination are more important than identifying various feedstuffs that may influence shedding.

Introduction

There were only eight recalls due to *E. coli* O157:H7 in ground beef in 2006, and all of them were initiated because of company sampling. However, in 2007, there were 20 recalls, nine of which resulted from illness investigation. Health officials looked for reasons why *E. coli* O157:H7 seemed to be a greater problem in 2007 compared to the previous four years. Because the ethanol industry grew in 2007 and feeding ethanol by-products increased, some theorized feeding ethanol byproducts was the cause of the *E. coli* O157:H7 recalls. Late in 2007, research (Jacob et al., 2008, *Applied and Environmental Microbiology* 74:38) showing a relationship between distillers grains (DG) feeding and *E. coli* O157:H7 shedding was reported.

Discussion

Subsequent studies of the relationship between feeding distillers grains and *E. coli* O157:H7 shedding indicate

that some researchers have found a correlation between the two, while others have not.

Jacob et al. (2008, *Journal of Animal Science*, 86:1182) reported a study using 370 feedlot cattle sampled at 122 and 136 days on feed. Overall prevalence of *E. coli* O157:H7 was fairly low (under 10%). On day 122, cattle were statistically more likely to shed *E. coli* O157:H7 when fed 25% DG in the diet. On day 136, feeding DG had no effect on shedding. Jacob et al. (2008, *Applied and Environmental Microbiology* 74:38-43) sampled cattle for 12 weeks during the feeding period. Fecal samples were collected from the pen floor. Feeding DG significantly increased *E. coli* O157:H7 shedding, although no difference was reported in five of the 12 sampling periods.

Jacob et al. (*Zoonoses and Public Health* 55:125) conducted a challenge experiment in which calves were inoculated with nalidixic acid-resistant *E. coli* O157:H7, allowing researchers to estimate the number of *E. coli* O157:H7 shed. Fecal samples were collected for 42 days. *E. coli* O157:H7 shedding was not different for calves fed DG during the first five weeks, but was statistically greater during the last week of sampling. Based on these three studies, researchers concluded that DG feeding increased *E. coli* O157:H7 shedding. In each of the three experiments there were sampling times when DG statistically increased shedding; however, as with most results in *E. coli* O157:H7 research, the results were somewhat inconsistent, making interpretation of the results difficult.

Recently, Jacob et al. (*Journal of Animal Science* 86, E Suppl:26) reported results of an experiment using 700 cattle fed for 150 days — half were fed DG. Pen floor samples were collected weekly or every two weeks; a total of 3,560 samples were collected and analyzed. Overall prevalence of *E. coli* O157:H7 was fairly low

(5.1%). Although prevalence of *E. coli* O157:H7 in pen floor fecal samples was numerically higher in cattle fed DG in some sampling weeks, there was no significant effect of DG ($P = 0.2$).

All the previous studies were conducted with steam-flaked corn (SFC) diets with or without 25% (DM basis) DG. This may be important as we compare other research projects and results. Corrigan et al. (2007 *Nebraska Beef Report*, pp. 33-35) reported DG does not respond the same in SFC diets compared to dry-rolled corn (DRC) or high moisture corn diets (HMC). If cattle gains and efficiencies respond differently to DG levels in SFC and DRC or HMC diets, then it is possible any effects on *E. coli* O157:H7 vary as well. Our *E. coli* O157:H7 research is with DRC or HMC only.

It is logical that the diet fed to cattle could influence the growth of *E. coli* O157:H7 in the hindgut, since research has shown the primary reservoir of *E. coli* O157:H7 is the hindgut and *E. coli* O157:H7 attach to the intestinal wall of the hindgut. Interestingly, *E. coli* O157:H7 have no effect on cattle performance. There are two opposing theories on how the diet affects *E. coli* O157:H7 in the hindgut. The first theory is that starch escaping digestion in the rumen and small intestine is fermented in the hindgut, producing volatile fatty acids and lowering pH, thus inhibiting growth of *E. coli* O157:H7. Fox et al. (2007, *Journal of Animal Science* 85:1207-1212) showed support for this theory; steam flaking corn reduced starch in the hindgut and increased *E. coli* O157:H7 shedding. However, Depenbusch et al. (2008, *Journal of Animal Science* 86:632-639) said “*E. coli* O157:H7 was not related to fecal pH or starch.” We reanalyzed the data of Peterson et al. (2007, *Journal of Food Protection* 70:287-291) showing that diets with decreasing amounts of corn decreased the amount of starch

(Continued on next page)

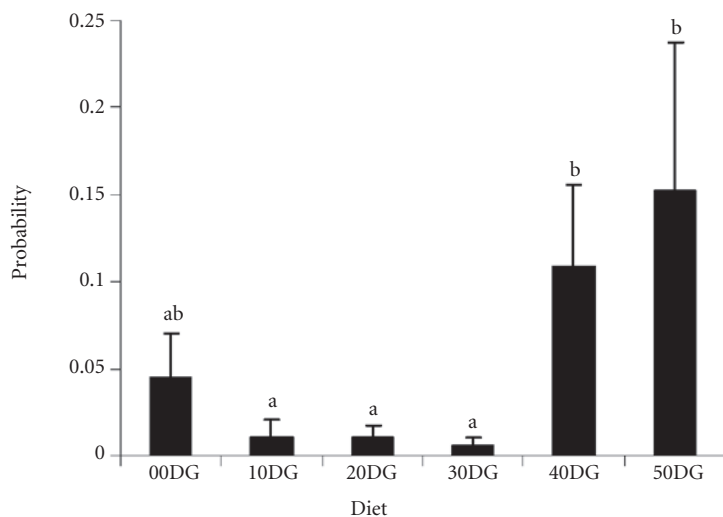


Figure 1. Effect of level of WDGS on *E. coli* O157:H7 colonization by cattle. Adapted from Peterson et al. (2007 *Journal of Food Protection*, 70:2568). 00DG = corn control diet with no WDGS; 10DG = 10% WDGS; 20DG = 20% WDGS; 30DG = 30% WDGS; 40DG = 40% WDGS; 50DG = 50% WDGS. ^{a,b,c} Treatment means with unlike letters differ.

in the diet. Amount of starch in the diet was not related to *E. coli* O157:H7 shedding ($P = .22$).

The opposing theory is starch in the hindgut is the substrate for *E. coli* O157:H7, so by reducing the amount of starch getting to the hindgut, *E. coli* O157:H7 would be reduced. Reports of Peterson et al. (2007, *Journal of Food Protection* 70:287-291) and Folmer et al. (2003, *Nebraska Beef Report*,

pp. 22-23) did not support this theory. While it is logical that diet affects *E. coli* O157:H7 growth in the hindgut, clearly neither of the two opposing “starch theories” has been “proven.”

Peterson et al. (2007, *Journal of Food Protection* 70:2568-2577) focused on vaccination as an *E. coli* O157:H7 intervention. Because the study was superimposed on a nutrition study, we reanalyzed the data (Figure 1).

Wet DG were fed as 0%, 10%, 20%, 30%, 40% and 50% of diet dry matter replacing DRC and HMC. In this experiment, samples of the hindgut mucosa, as well as fecal samples, were analyzed. Results were similar but more consistent for the mucosal samples (Figure 1). There was a significant effect of level of DG on *E. coli* O157:H7 shedding; however, it was not a linear relationship. None of the levels of DG feeding were statistically different from the control (0DG). The 10%, 20% and 30% DG levels numerically decreased the shedding of *E. coli* O157:H7. Interestingly, this is within the range of feeding (25%) discussed previously with SFC. Our research is with DRC and HMC while the previous research was with SFC, which may make a difference.

At the 40% and 50% DG feeding level, *E. coli* O157:H7 shedding numerically increased compared to the control. Note that the statistical difference is between the 10%, 20% and 30% DG levels and the 40% and 50% levels. So does DG decrease or increase *E. coli* O157:H7 shedding?

Peterson et al. (2007, *Journal of Food Protection* 70:2568-2577) were studying vaccination. The pattern of *E. coli* O157:H7 in hindgut mucosa

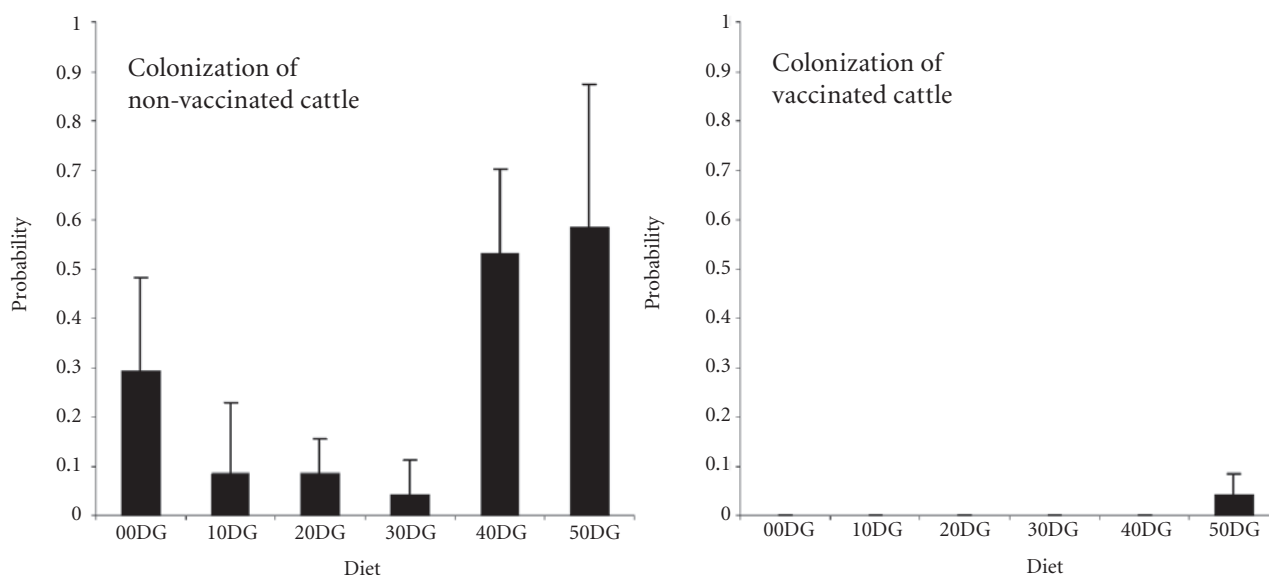


Figure 2. Effect of level of WDGS on *E. coli* O157:H7 colonization of unvaccinated or vaccinated against *E. coli* O157:H7. Adapted from Peterson et al. (2007 *Journal of Food Protection*, 70:2568-2577). 00DG = corn control diet with no WDGS; 10DG = 10% WDGS; 20DG = 20% WDGS; 30DG = 30% WDGS; 40DG = 40% WDGS; 50DG = 50% WDGS.

for unvaccinated cattle was similar to that discussed previously (Figure 2). However, only one steer among the vaccinated cattle tested positive, and that was at the 50% DG feeding level. In four studies involving 1,784 cattle, vaccination has reduced *E. coli* O157:H7 shedding by 65%. This is equivalent to the effect of winter versus summer on shedding. Feeding a direct-fed microbial (Peterson et al., 2007, *Journal of Food Protection* 70:287-291) reduced shedding over two years by 35%. These two interventions plus others being researched have considerable merit.

Conclusions

It is reasonable to think that what we feed cattle might affect the bacterial population of the hindgut.

Research suggests that under some feeding levels and some other yet-to-be-determined conditions, DG may increase *E. coli* O157:H7 shedding.

Results of *E. coli* O157:H7 research in general and specifically with DG feeding are inconsistent. To date, no consistent effect of DG feeding on *E. coli* O157:H7 shedding has been shown.

Response in *E. coli* shedding to DG feeding may be affected by DG level

and other dietary ingredients such as the corn type.

Interventions and research on interventions are important.

At this point, there is contradictory evidence that feeding DG, at least at levels being used commercially, increases *E. coli* O157:H7 shedding. Additionally, there is no scientific evidence to suggest that the feeding of DG is the cause of the 2007 recalls.

¹Terry J. Klopfenstein, professor, and Galen E. Erickson, associate professor, Animal Science, Lincoln, Neb. David R. Smith and Rodney A. Moxley, professors, Veterinary and Biomedical Sciences, Lincoln, Neb.