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Amy R. Rich
University of Nebraska - Lincoln, arr@huskers.unl.edu

Ashlynn N. Jepson
University of Nebraska - Lincoln

Matt K. Luebbe
University of Nebraska - Lincoln, mluebbe2@unl.edu

Galen E. Erickson
University of Nebraska-Lincoln, gerickson4@unl.edu

Terry J. Klopfenstein
University of Nebraska-Lincoln, tklopfenstein1@unl.edu

See next page for additional authors

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Authors

Amy R. Rich, Ashlynn N. Jepson, Matt K. Luebbe, Galen E. Erickson, Terry J. Klopfenstein, David R. Smith, and Rodney A. Moxley

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Vaccination to Reduce the Prevalence of *Escherichia Coli* O157:H7 in Feedlot Cattle Fed Wet Distillers Grains Plus Solubles

Amy R. Rich
Ashlynn N. Jepson
Matt K. Luebbe
Galen E. Erickson
Terry J. Klopfenstein
David R. Smith
Rodney A. Moxley[1]

Summary

A clinical trial in summer of 2008 evaluated effects of feeding 0 (CONTROL) or 40% wet distillers grains plus solubles (WDGS) with and without vaccination against E. coli *O157:H7 on the probability of shedding* E. coli *O157:H7 in the feces. No interaction (P = 0.97) was observed between vaccination and diet for* E. coli *O157:H7 shedding. Steers fed WDGS were 2.1 times more likely (P < 0.01) to shed* E. coli *O157:H7 than cattle fed CONTROL. Vaccination resulted in cattle that were 43% less likely (P < 0.01) to test positive for* E. coli *O157:H7 than the unvaccinated cattle.*

Introduction

Results of vaccinating feedlot cattle against type III secreted proteins of *Escherichia coli* O157:H7 as have been reported in several beef reports (*2008 Nebraska Beef Report*, pp. 92-94; *2006 Nebraska Beef Report*, pp. 68-69; *2006 Nebraska Beef Report*, pp. 70-71; *2005 Nebraska Beef Report*, pp. 61-63). Peterson et al. (2007, *Journal of Food Protection 70:287-291*) tested the effects of vaccinating cattle against *E. coli* on the probability of detecting *E. coli* O157:H7 in feces and colonization at the terminal rectum in cattle on diets including 0, 10, 20, 30, 40, and 50% inclusion of distillers grains. Cattle fed 0% distillers had numerically greater colonization than steers fed 10, 20, or 30% distillers, but the difference was not statistically significant. Likewise, numerically fewer steers fed 0% distillers were colonized with *E. coli* O157:H7 compared to steers fed 40% or 50% distillers, but again, the difference was not statistically significant. In that study, the significant diet effect was for steers fed 40 or 50% distillers compared to steers fed 10, 20, or 30% distillers. Our objective was to test the effect of feeding 0 and 40% distillers grains, with or without vaccinating against type III secreted proteins of *E. coli* O157:H7, on shedding of *E. coli* O157:H7 in feces of feedlot cattle.

Procedure

The clinical trial was conducted from May to October of 2008 at the beef research feedlot at the University of Nebraska Agricultural Research and Development Center using 480 steers in 60 pens. Pens were assigned randomly to one of four treatments (15 pens per treatment) in a 2x2 factorial treatment design. The two factors were diet and vaccination treatment. The dietary treatments were either 0% distillers finishing diets (CONTROL) or diets containing 40% wet distillers grains plus solubles (WDGS). The vaccination treatment was a 3-dose vaccination regimen or no vaccination. The treatments were assigned to pens of cattle within two sampling blocks and assigned randomly to either the north or south feeding facilities. The vaccine, marketed in Canada as Econiche by Bioniche Life Sciences, was administered as a 2-ml subcutaneous injection. In the present study, a 3-dose vaccine regimen was given on feeding days 1, 25, and 53 to the cattle receiving that treatment. Steers that were not vaccinated were handled similar to the vaccinated steers, but received no vaccine injection. Five days prior to the initiation of the trial, steers were limit fed at 2% of BW to minimize variation in rumen fill. Steers were fed a 1:1 ratio (DM basis) of alfalfa hay and wet corn gluten feed during limit feeding. Steers were weighed individually on days 0 and 1 to determine initial BW. Steers (783 +/- 40 lb) were stratified by BW and assigned randomly to pens (8 steers/pen) based on day 0 BW.

All diets contained 15% corn silage, 5% supplement, and corn fed as high moisture corn (HMC) and dry rolled corn at a 3:2 ratio (DM basis). The WDGS treatment contained wet distillers grains with solubles at 40% inclusion, which replaced the corn mixture. Steers were adapted to finishing diets in 21 days by replacing alfalfa hay with the 3:2 mixture of HMC and DRC. On day 25 of the experiment, calves were implanted with Revalor-S. Steers were slaughtered on day 159.

Fecal samples were obtained from the rectum on days 75, 96, 117, and 138. The samples were labeled with a bar code, which blinded the laboratory personnel to animal identification and treatment, and sent within a few hours of collection to Food Safety Net Services in San Antonio, Tex., for culture. Standard broth enrichment and plate culture methods (*2008 Nebraska Beef Report*, pp. 92-94) with modifications were used to yield a positive or negative result for the presence of *E. coli* O157:H7 in the feces. Identity of each isolate was confirmed by standard methods, including PCR.

The effect of vaccine treatment on the probability of detecting *E. coli* O157:H7 from feces was modeled using multi-level logistic regression (GENMOD, SAS Institute, Cary, N.C.). Factors included in the model were the main effects of dietary treatment and vaccination, the interaction between diet and vaccination, sampling block, location within the feedlot, and test period (date of sampling). Least squared means of the

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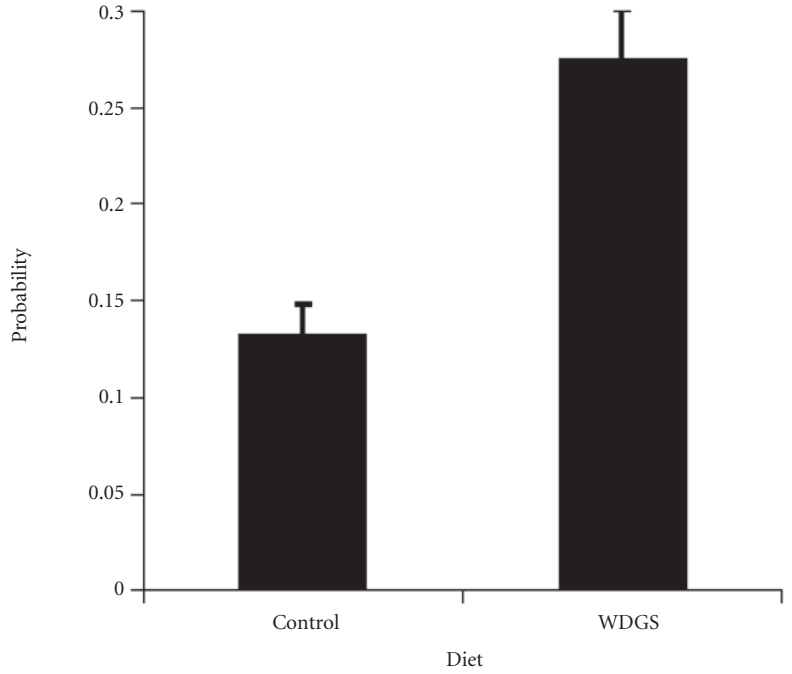

Figure 1. Probability of steers shedding *E. coli* O157:H7 in the feces as influenced by feeding 40% wet distillers grains (WDGS) or none (CONTROL) to finishing cattle.

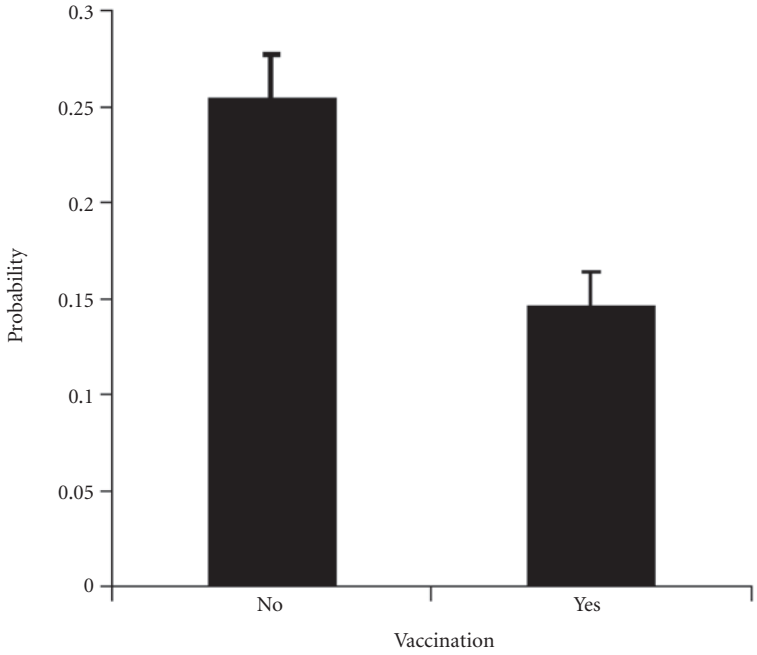

Figure 2. Probability of steers shedding *E. coli* O157:H7 in feces as influenced by vaccination treatment.

parameter estimates from the multivariable analysis were used to calculate adjusted probabilities for fecal shedding by treatment level. Relative risk (RR) values for each vaccine treatment were calculated from the adjusted probabilities.

Results

There was no interaction ($P = 0.97$) between diet and vaccination; therefore, the main effects of diet and vaccination are presented. Likewise, no test period by treatment interaction was observed ($P > 0.40$) or effect of test period ($P = 0.17$). Sampling block and location within the feedlot were variables impacting *E. coli* O157:H7 shedding ($P < 0.01$) and were accounted for in the model. *E. coli* O157:H7 was detected in 369 of the 1899 fecal samples or 19%. For steers fed WDGS and vaccinated, *E. coli* O157:H7 was detected in 94 of 477 samples, or 19.7%, and 43 of 478 samples for vaccinated steers fed CONTROL, or 9.0%. Among unvaccinated steers, *E. coli* O157:H7 was detected in 154 of 470 samples (32.8%) for steers fed WDGS, versus 78 of 474 samples (16.5%) for CONTROL steers.

Feeding WDGS increased ($P > 0.01$) the probability for shedding *E. coli* O157:H7 by 2.1 times in this study when distillers was fed at 40% of diet DM (Figure 1). Vaccinating steers was effective ($P < 0.01$) at reducing *E. coli* O157:H7 shedding by 43%, a slightly lower effect than seen in previous vaccine trials (Figure 2). Previous data collected by Peterson et al. (2007) suggested that feeding higher levels (40 and 50% DM) of wet distillers grains increases the prevalence of *E. coli* O157:H7; however, the lower levels that are more commonly fed resulted in significantly lower colonization than high levels. Peterson et al. (2007) also reported that there was not a significant difference between any level of WDGS inclusion and their control or 0% distillers grains. Results from the current study suggest that feeding 40% WDGS increases the shedding of *E. coli* O157:H7, similar to the numerical differences in colonization observed by Peterson et al. (2007). The impact of feeding distillers grains on shedding of *E. coli* O157:H7 is likely dependent on dietary inclusion; however, vaccination mitigates the risk.

[1]Amy R. Rich, graduate student, Matt K. Luebbe, technician, Galen E. Erickson, associate professor, Terry J. Klopfenstein, professor, Animal Science, University of Nebraska, Lincoln, Neb.; Ashlynn N. Jepson, undergraduate student, David R. Smith, professor, Rodney A. Moxley, professor, Veterinary and Biomedical Sciences, UNL.

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