

Introduction

Escherichia coli is one of the most well-known pathogens due to its persistence even in modern countries. *E. coli* O157:H7 causes 73,000 illnesses in the United States annually (Rangel et al., 2017). Raw or undercooked meat possess one of the greater opportunities for infection. Safe at-home procedures to decontaminate meat become necessary to reduce *E. Coli* prevalence. Effective procedures that do not hinder quality are ideal solutions.

Objective

The purpose of this research project was to evaluate the effect of white vinegar and black pepper on the presence of *E. coli* K12 in round steak due to the commonality of the usage of these ingredients in marinades and their potential to decrease the prevalence of *E. coli* without hindering quality.

Experimental Procedures

The experiment was conducted over 7 days. On Day 0, three round steaks were inoculated with 300 µl of *E. coli* K12. One steak was used for a positive control and two for interventions. One steak was left uninoculated as a negative control. Two inoculated cuts were treated with 5 grams of black pepper and 250 ml of white vinegar, respectively. Dilutions were created from 10 g samples of the positive and negative controls and plated on Day 0. Dilutions were created from 10 g samples of the positive and negative controls in addition to the black pepper and white vinegar treatments and were stomached on Days 2 and 7. Various dilutions were plated on MacConkey agar (indicative of *E. coli* presence), Potato Dextrose Agar (indicative of yeast and mold), and Plate Count Agar (indicative of total viable bacteria) over the course of the experiment to allow for proper growth. All data was statistically analyzed with SAS v. 9.4.

Round Steak

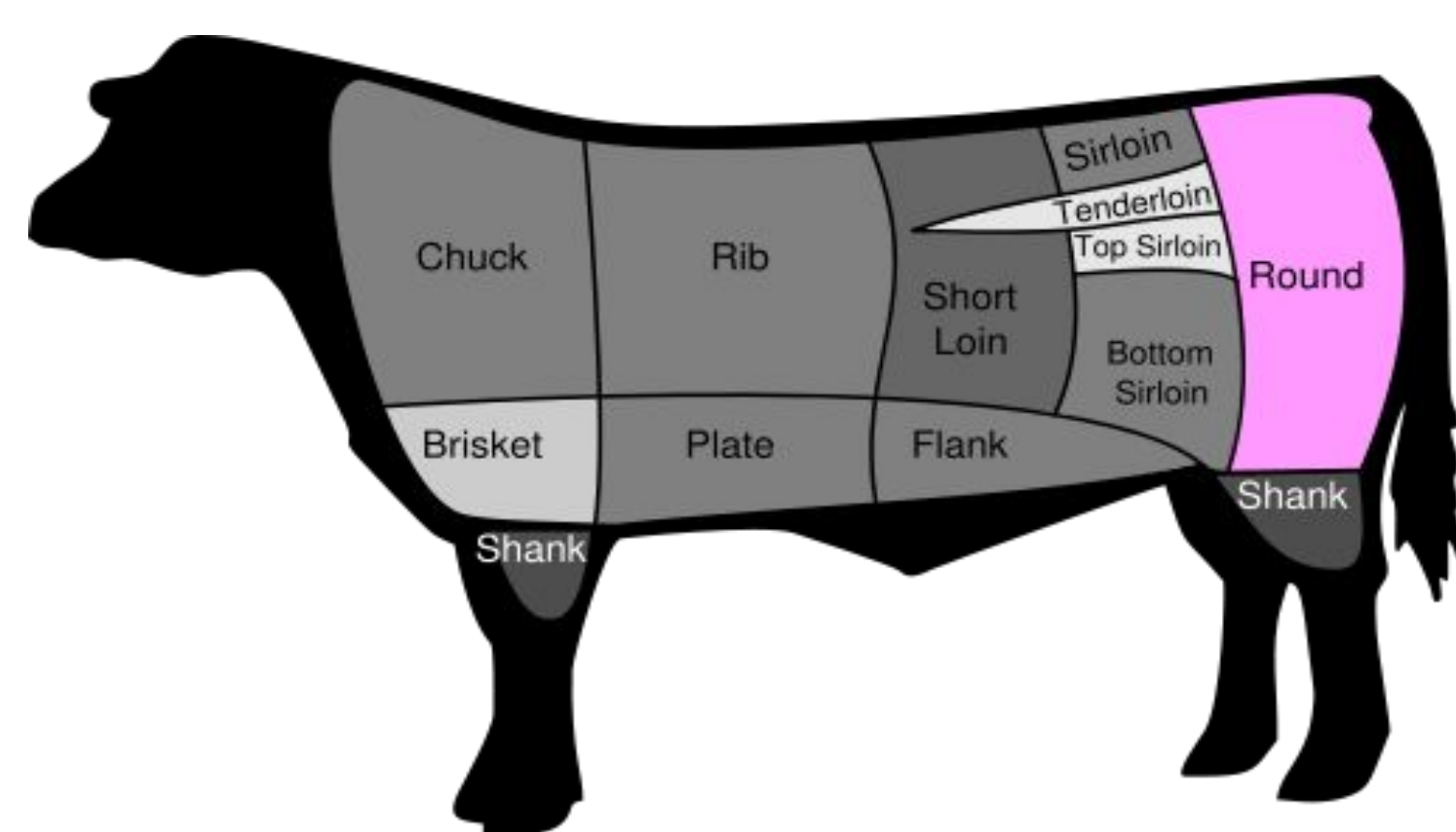


Figure 1. Location of Round Steak Cut



Figure 2. Round Steak Cuts

Plating and Materials

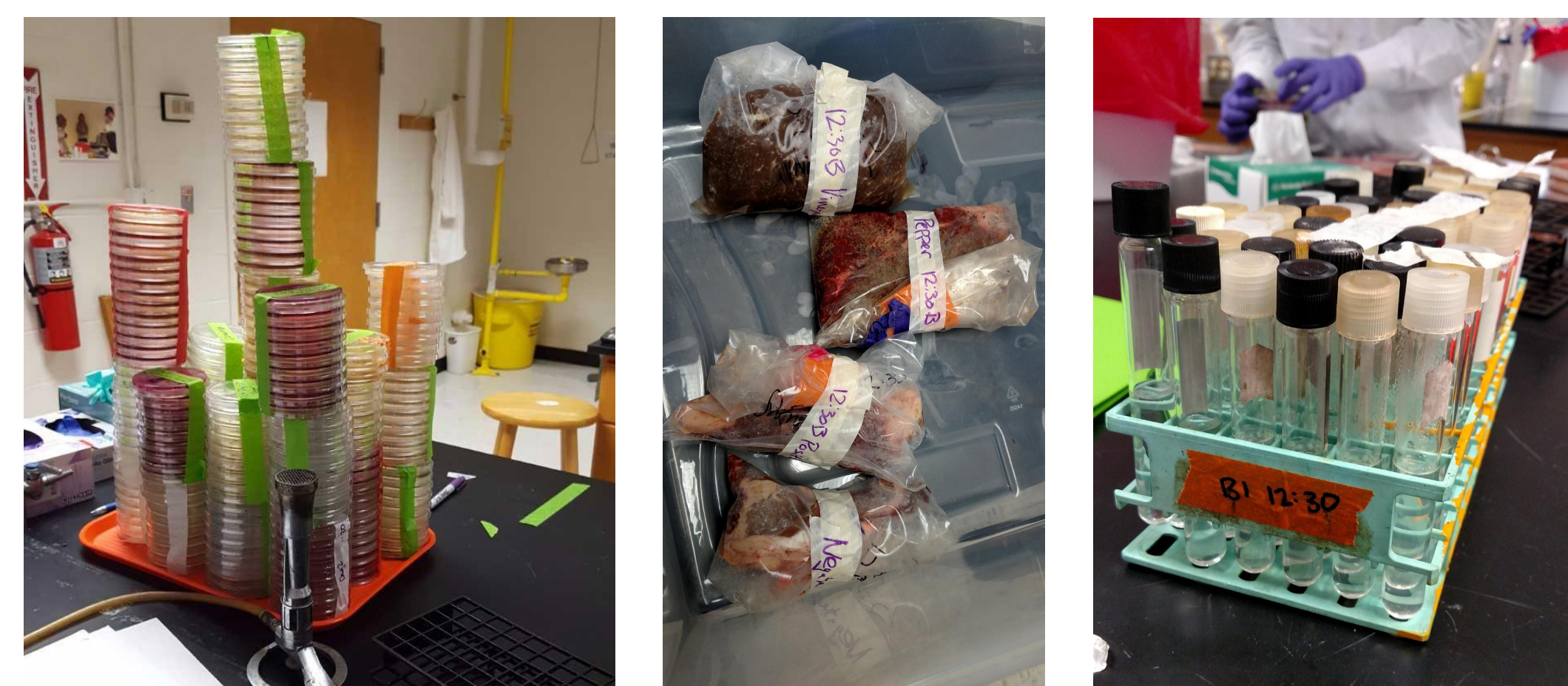


Figure 3. 270 plates used in study, Figure 4. Treatments being 'marinated', Figure 5. Dilution tubes



Figure 6. Zero presence of *E. coli* K12 for the vinegar treatment on Day 7 MacConkey agar, Figure 7. Collection of plate count data

Results

- Time and white vinegar displayed a statistical decrease in the presence of *E. coli* K12 (p-values .0001 and .008 respectively).
- Time and white vinegar displayed a statistical reduction in the presence of yeast and molds (p-values .038 and .024 respectively).
- White vinegar demonstrated a 1.2 log reduction in the presence of *E. coli* K12.
- Black pepper did not show a statistical difference in reducing the presence of *E. coli* K12.

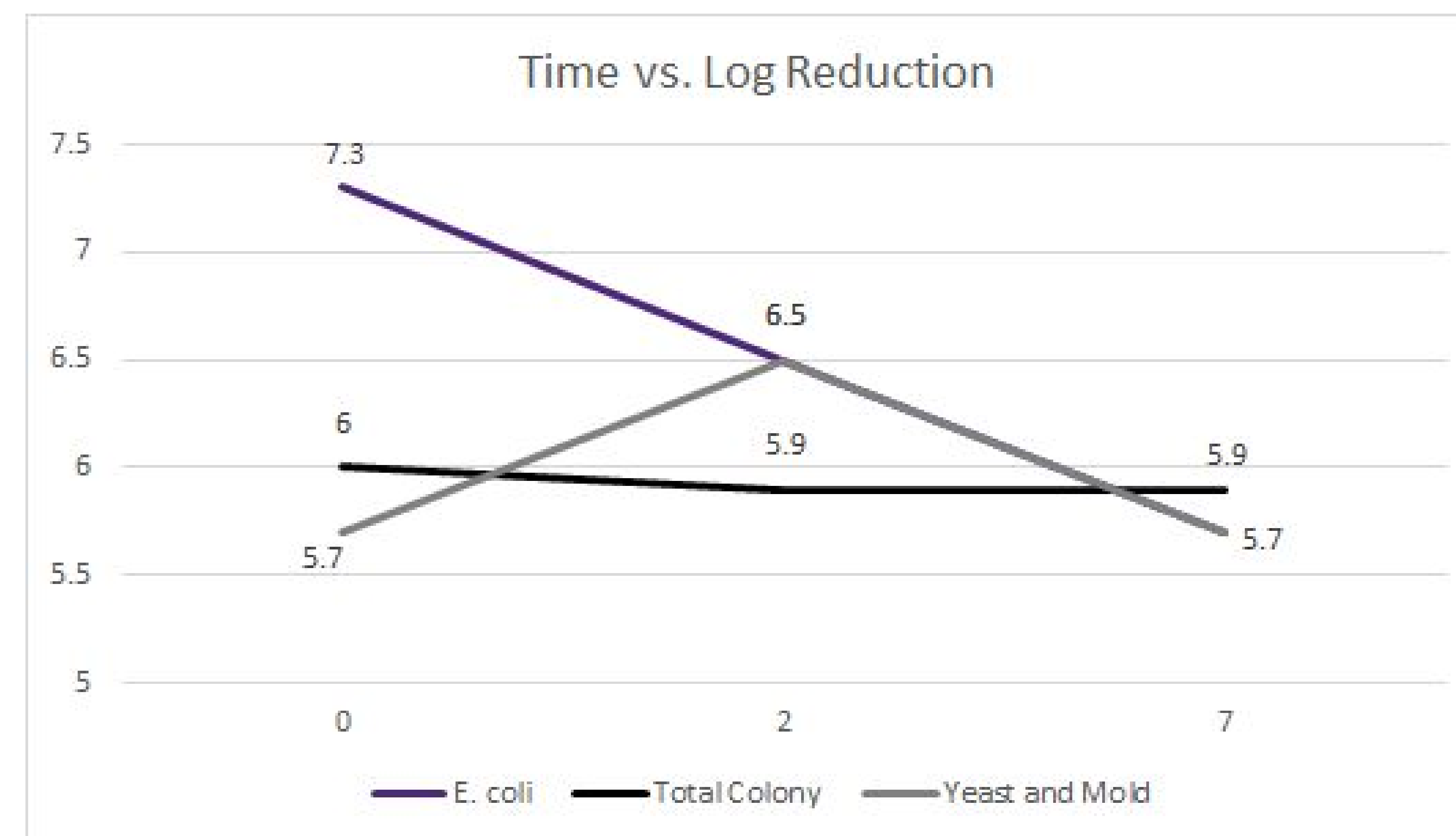


Chart 1. Average growth of all interventions and controls combined per day

Logarithmic Growth

Plate	Negative Control	Positive Control	Vinegar	Pepper
<i>E. Coli</i>	6.4	7.0	5.8	6.9
Total Colony	5.7	6.2	5.7	6.3
Yeast and Mold	5.8	6.4	6.3	6.5

Table 1. Logarithmic growth per treatment over all days combined

Conclusion

In beef round steak, white vinegar showed a significant reduction in *E. coli* K12, yeasts and mold. Ground pepper did not significantly reduce growth of *E. coli* K12, yeast or mold. The results also concluded that both *E. coli*, yeasts and molds were, on average, reduced over time. These results determine that white vinegar may provide useful in the control of *E. coli*, yeast and mold if added to a marinade and the steak was refrigerated over a range of two to seven days.

References

Rangel, J.M., Sparling, P.H., Crowe, C., Griffin, P.M. and Swerdlow, D.L. (2017). *Epidemiology of Escherichia coli* O157:H7 Outbreaks, United States, 1982-2002.