



Evaluation of the Reduction of *E. Coli* in Beef Ribeye Rolls at Temperatures Lower Than 54.4°C

B. Mendes*, E. Krage, J. Henson, and A. G. Mckeith

Animal Sciences and Agricultural Education, California State University, Fresno, CA, USA

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Objectives

According to the CDC, *Salmonella* is a leading cause of gastroenteritis in humans and continues to be significant in relation to public health concerns for the food industry. This may be attributed to inadequate heating/cooking. The lowest temperature and holding time the USDA recommends in Appendix A to achieve a 6.5- \log_{10} reduction in *Salmonella* is 54.4°C for 112 min. To date there is limited research in utilizing lower temperatures for ribeye rolls to increase juiciness and perceived tenderness. This study evaluated the reduction of *Escherichia coli* in strip loins, top rounds and ribeye rolls cooked to internal temperatures of 54.4°C or lower to determine if temperatures less than 54.4°C would achieve a 6.5- \log_{10} reduction in accordance with Appendix A.

Materials and Methods

A local company provided their proprietary brine and rub ingredients and raw meat materials for the experiment. A cocktail of five stains of *Escherichia coli* (ATCC BAA-1427, 1428, 1429, 1430, 1431) were utilized. These strains are approved by the USDA as surrogates for *Salmonella* for inplant verification studies. Ribeye rolls were dip inoculated with *E. coli* to achieve a 7.5- \log_{10} CFU per gram inoculation level on the meat. Ribeye rolls were pumped 15% with a brine solution and then rubbed with the rub. They were then placed into cook-in bags and vacuum-sealed. Packages were placed on a smokehouse trolley in the smokehouse. The combination of temperatures and times held were 54.4°C for 2 and 3 h, 51.7°C for 3 and 5 h, and 48.9°C for 10 and 12 h. Times were determined utilizing a model from the North American Meat Institute. Internal temperatures were continuously monitored utilizing Type-K

Thermocouples. Inoculations were prepared by inoculating TSB with each *E. coli* strain and allowed to grow at 37°C for approximately 24 h. Once removed from the smokehouse 1-kg samples were taken from each ribeye roll and were vacuum-packaged for *E. coli* enumeration. Samples were taken to Food Safety Net Services for enumeration. MacConkey Sorbital Agar was utilized to determine *E. coli* survival. The experiment consisted of three replications with 2 samples per replication. Data were analyzed using excel and the GLM procedure of SAS (SAS Inst. Inc., Cary, NC) to determine average reduction of *E. coli* in top rounds.

Results

Ribeye rolls had a 6.3- \log_{10} reduction (var = 0.1) at 54.4°C when held for 2 h and a 6.5- \log_{10} reduction (var = 0.01) when held for 3 h. When held at an internal temperature of 51.7°C a 6.08- \log_{10} reduction (var = 0.74) was achieved when held for 3 h and a 5.43- \log_{10} reduction (var = 0.22) when held for 5 h. The lower reduction when held at for a longer period of time may have occurred due to a sample having a higher inoculation level or contamination during sampling. Ribeye rolls that were cooked to 48.9°C and held for 10 h resulted in a 5.3- \log_{10} reduction (var = 1.07) and when held for 12 h achieved a 6.1- \log_{10} reduction (var = 0.36).

Conclusion

Results suggest that lower temperatures may possibly achieve a 6.5–7.0- \log_{10} reduction in accordance with Appendix A if the product was held at the temperature for the correct time. This information is useful for companies that wish to use other temperature/time relationships than those stated in Appendix A.