



Evaluation of The Reduction of *E. Coli* in Beef Top Rounds at Temperatures Lower than 54.4°C

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

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

Keywords: Appendix A, beef, *E. coli*, Salmonella
Meat and Muscle Biology 1(2):113

doi:10.221751/rmc2016.110

Objectives

The CDC states that *Salmonella* is a leading cause of gastroenteritis in humans and continues to be significant in relation to public health concerns for the meat and food industries. 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. Limited research exists in using lower temperatures for top rounds to comply with Appendix A standards. Some companies wish to utilize lower temperatures to maintain juiciness and tenderness during the reheating process. This study was conducted in an USDA inspected meat facility, therefore, surrogate bacteria that are approved for use by the USDA as surrogates for *Salmonella* were utilized. This study evaluated the reduction of *Escherichia coli* in top rounds cooked to internal temperatures of 54.4°C or lower to determine if temperatures lower 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 5 stains of *Escherichia coli* (ATCC BAA-1427, 1428, 1429, 1430, 1431) were utilized. These 5 stains are approved surrogates by the USDA to be used for inplant verifications studies. Top rounds were dip inoculated with *E. coli* to start with a 7.5- \log_{10} CFU per a gram inoculation level on the meat. Top rounds were pumped 15% with a brine solution and then rubbed with the rub. They were then placed into netting and placed on a smokehouse trolley in the smoke-

house. 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 with 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. MacConkey Agar was utilized to determine *E. coli* survival. The experiment consisted of three replications with two 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

Top rounds had a 4.0- \log_{10} reduction (var = 0.78) at 54.4°C when held for 2 h and a 4.38- \log_{10} reduction (var = 0.48) when held for 3 h. This is different than Appendix A, as only 50% relative humidity was utilized in the smokehouse schedule to maintain the low cooking temperature. According to Appendix A a 90% relative humidity should be utilized during the cooking process. When held at an internal temperature of 51.7°C a 3.79- \log reduction (var = 0.01) was achieved when held for 3 h and a 4.23- \log_{10} reduction (var = 0.28) when held for 5 h. Top rounds that were cooked to 48.9°C and held for 10 h resulted in a 2.87- \log_{10} reduction (var = 0.18) and when held for 12 h resulted in a 2.91- \log_{10} reduction (var = 0.17).

Conclusion

Results suggest that 50% relative humidity and the low cooking temperatures were not sufficient to achieve the 6.5- \log_{10} reduction that is mandated by Appendix A.