

Microbial Validation of Ethiopian Beef Jerky Formulations with the Inclusion of Dates and Raisins

Jessica Brown, Gabrielle Allen, Ashley Cavallo, Arie Havelaar, Jason Scheffler

Department of Animal Sciences, University of Florida, Gainesville, United States

Introduction: Ethiopia has the largest livestock inventory in Africa yet has one of the lowest per capita red meat consumptions. Part of this is due to an inconsistent power grid making refrigeration unreliable and limiting meat shelf life. Drying is one of the oldest methods of food preservation, involving the addition of salt and removal of water to make a shelf-stable, and nutrient dense product, but pathogens like *Salmonella* may desiccate and survive a conventional drying process. Dates and raisins are two dried fruits that are available to Ethiopian producers and contain a high concentration of antimicrobial phenolic compounds. Their incorporation into a dried beef jerky may improve pathogen control and increase marketing options. The objective of this study was to quantitatively evaluate the antimicrobial effects of including dates and raisins into a restructured beef jerky formulation designed to be produced under the constraints of an Ethiopian butcher shop.

Materials and methods: Challenge studies were performed to evaluate the inactivation of five serotypes of *Salmonella enterica* (Saint Paul, Anatum, Typhimurium, Newport, Dublin), three strains of *E. coli* O157:H7, and three strains of *Campylobacter jejuni*. Lean, trimmed beef was ground and seasoned with berbere, an Ethiopian spice mixture, and salt (2.5% in raw formulation(w/w)). Pureed dates and raisins were included at 15% (w/w) for a total of three treatment groups (control, dates, raisins). Each treatment was inoculated with a cocktail of isolates, formed into strips, and dehydrated for 6 h in a home-style dehydrator (600W) with a target temperature of 70°C. Samples were weighed pre- and post-drying, plated for enumeration at 0, 1, 2, 3, 4, 5, and 6 h, and aw was measured for each treatment at each sampling interval. Data were log transformed and analyzed using the Tukey (HSD) method with pairwise comparisons.

Results: The dry-bulb temperature within the dehydrator steadily increased for the first 3 h of drying before stabilizing at 67.2±0.2°C with a relative humidity of approximately 12%. The final weight loss was not affected by treatment, but the inclusion of dates and raisins reduced the water activity compared to the control strips. After 6 h of drying, all treatments achieved at least a 4.7, 6.1, and 3.9-log reduction of *Salmonella*, *E. coli* O157:H7, and *Campylobacter*, respectively. The inclusion of dates improved the overall reduction of *Salmonella* by 0.65-log CFU/g, compared to the control group (P=0.018). The lethality of *E. coli* O157:H7 and *Campylobacter* were not affected by treatment; however, the extent of the *Campylobacter* reduction was likely underestimated due to the limit of detection.

Conclusions: The validation of additional processes to extend the shelf life of ASFs in Ethiopia not only provides consumers with another, more convenient source of protein, but it also creates an additional avenue for producers to market their product. The inclusion of antimicrobial ingredients has the potential to create a safer product and broadens the creative license for Ethiopian producers to develop new flavors, encouraging market competition and increasing marketplace acceptance.

Acknowledgements and Financial support statement: The authors would like to thank the University of Florida Meat Science group for their support of this research. This research was funded by the Bill & Melinda Gates Foundation and the Department for International Development.