



## Effects of Enhancement Techniques on Physical And Chemical Properties of Beef Flanks

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### Objectives

Enhancement of beef with non-meat ingredients is a common practice to improve both palatability and chemical characteristics. However, the delivery method of brine solutions has not been well studied and could play a role in the activity of certain ingredients, ultimately influencing meat characteristics. This study was designed to determine if different enhancement methods impacted the overall physical and chemical properties, including pH, percent pick-up, slice shear force (SSF), and cooked moisture content, of enhanced (water, salt and sodium tripolyphosphate) *rectus abdominus*.

### Materials and Methods

USDA Select beef flank steaks (*rectus abdominus*) were procured from a beef abattoir and processed at 10 d postmortem. Steaks ( $n = 100$ ; 20/treatment) were denuded and assigned randomly to one of the five treatments: untreated control (CNT), vacuum tumbled without marinade (TCNT), vacuum tumbled with marinade (TUMB), needle injected with marinade (INJ), and injected with marinade plus vacuum tumbled (IPT). Initial weight and pH were collected pre-enhancement for TUMB, INJ, and IPT. Samples were weighed again immediately after enhancement and 20 min after enhancement. Three weights were collected for IPT: pre-enhancement, post-injection and post-tumble. After flank enhancement, they were sliced in half parallel to the muscle fiber. One half was designated for laboratory analysis. The halves were then frozen and thawed 24 h prior to cooking. A 50-g raw sample was obtained from each flank prior to cooking for SSF to analyze raw moisture content. Each flank was cooked to an internal temperature of 72°C and allowed to rest for 3 min prior to slicing for SSF.

### Results

Treatment influenced final pH ( $P < 0.01$ ), with final pH increasing in INJ, TUMB, and IPT. Differences were noted in final pH between treatments; INJ had the highest pH (6.15), followed by IPT (6.06), TUMB (5.83), CNT (5.76), and TCNT (5.71), with a difference observed between each treatment ( $P < 0.05$ ). Treatment also impacted ( $P < 0.01$ ) SSF. The addition of marinade through injection and tumbling reduced ( $P < 0.05$ ) SSF values, as CNT and TCNT had greater SSF values compared to all other treatments. Injection further reduced SSF values, as INJ and IPT had lower SSF values compared to TUMB ( $P < 0.05$ ). Cooked moisture was also influenced ( $P < 0.01$ ) by treatment. IPT and TUMB had greater moisture percentage compared to all other treatments; INJ was intermediate, and CNT and TCNT similarly had lower moisture percentage than the remaining treatments ( $P < 0.05$ ). Of the three treatments that involved marination, initial and final percent pick-up and drip loss were all influenced by treatment ( $P < 0.01$ ). Initially, INJ (14.5%) had the greatest percent pick-up, IPT was intermediate (12.9%), and TUMB had the lowest percentage (11.8%). However, drip loss was greatest for INJ (2.3%), intermediate for TUMB (0.2%), and lowest for IPT (0.0%). Final percent pick-up was now greatest for IPT (12.9%), intermediate for INJ (11.9%), and lowest for TUMB (11.5%).

### Conclusion

Enhancement methods can influence physical and chemical traits in terms of moisture, SSF and pH. Injection influenced shear force more than tumbling, whereas tumbling had greater effects on moisture than injection. Combining injection with tumbling had the most positive effect on shear force as well as moisture retention.