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Influence of post-harvest circulatory rinse on tenderness and objective color of cow striploin steaks.

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Objective

The objective of this study was to compare the effect of a post-harvest rinse of an isotonic solution through the circulatory system on tenderness of steaks from cows.

Study Description

Cows ($n = 28$) were randomly assigned to carcass treatments consisting of non-rinsed control ($n = 14$) and a rinsed treatment, ($n=14$) in which a chilled isotonic solution (MPSC, Inc., St. Paul, MN) was rinsed through the carotid artery and veins following exsanguination. Steaks (1 inch) were fabricated from strip loins and objective color was recorded. Steaks were vacuum packaged and aged at 39 °F for 7, 14, and 21 days. Warner-Bratzler Shear Force (WBSF) was used to measure tenderness. Frozen steaks were thawed at 39°F for 24 h before cooking. Internal temperature was monitored on all steaks using a digital thermometer. Steaks were cooked on an electric clamshell grill to an internal temperature of 160°F. Six cores (0.5 inch) were removed from each steak and sheared perpendicular to the muscle fiber orientation. Data were analyzed using the MIXED procedure of SAS. Shear force data were analyzed as a repeated measure with time and treatment as fixed variables. Color data were analyzed as a completely randomized design using treatment as the fixed variable. Statistical significance was considered at an alpha of $P < 0.05$.

Take home points

Whole muscle cuts from cows are often less tender than cuts from young beef due to increased collagen associated with animal age. Steaks from the rinsed treatment were more tender ($P = 0.0005$), than steaks in the control treatment (7.74 ± 0.379 lbs. and 9.72 ± 0.384 lbs., respectively). Objective color was not impacted by rinse treatment ($P > 0.05$). Post-harvest circulatory rinse may be an efficacious method to improve tenderness and meat quality of cows.

Keywords: aging, circulatory rinse, cow, post-harvest, tenderness

Influence of post-harvest circulatory rinse on tenderness and objective color of cow striploin steaks

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Abstract

Whole muscle cuts from cows are often less tender than cuts from young fed beef due to increased collagen cross-linking associated with animal age. The injection of a rinse solution through the carotid artery following exsanguination has been shown to improve tenderness. The objective of this study was to compare the effect of a post-harvest rinse of an isotonic solution through the circulatory system on tenderness of steaks from cows. Cows ($n = 28$) were randomly assigned to carcass treatments. The carcass treatments consisted of non-rinsed control ($n = 14$) and a rinsed ($n = 14$) treatment, where a chilled isotonic solution (MPSC, Inc., St. Paul, MN) was rinsed through the carotid artery and veins following exsanguination. The isotonic solution consisted of water, glucose, maltose and phosphates. Both control and rinsed treatments were electrically stimulated. At two days postmortem, strip loins were removed from one side of each carcass. Strip loins were fabricated into 1-inch steaks at 3 days postmortem and objective color measurements (L^* , a^* and b^*) were recorded on a single steak after a thirty-minute bloom period. Steaks were vacuum packaged and aged at 39°F for 7, 14, and 21 day. Following aging, steaks were frozen (-4°F) for future analysis. Warner-Bratzler Shear Force (WBSF) was used to measure tenderness. Frozen steaks were thawed at 39°F for 24 hours before cooking. Internal temperature was monitored on all steaks using a digital thermometer that was placed in the center of each steak. Steaks were cooked on an electric clamshell grill to an internal temperature of 160°F. Peak cook temperature was recorded for each steak. Following cooking, steaks were cooled at 39°F and allowed to equilibrate to room temperature (68°F). Six cores (0.5 inches) were removed from each steak and sheared perpendicular to the muscle fiber orientation. The peak force was recorded for each core and the average calculated for each steak. Data were analyzed using the MIXED procedure of SAS (SAS Inst. Inc., Cary, NC). Shear force data were analyzed as a repeated measure with time and treatment as fixed variables. Color data were analyzed as a completely randomized design using treatment as the fixed variable. Statistical significance was considered at an alpha of $P < 0.05$ and trends at $0.05 \leq P < 0.10$. There was no interaction ($P = 0.6068$) between treatment and postmortem aging day. Steaks from the rinsed treatment were more tender ($P = 0.0005$), than steaks in the control treatment (7.74 ± 0.370 lbs and 9.72 ± 0.384 lbs, respectively). Postmortem aging influenced ($P = 0.0310$) tenderness. Steaks aged 7 days were less tender ($P = 0.0087$) than steaks aged for 21 days (9.22 ± 0.342 lbs and 8.20 ± 0.343 lbs, respectively), while 14-day steaks did not differ ($P > 0.05$) from those aged 7 days or 21 days. Objective color was not impacted by rinse treatment ($P > 0.05$). These data suggest that the application of a post-harvest rinse with an isotonic solution through the circulatory system improves the tenderness of cow steaks but does not influence objective color.

Introduction

In beef cattle, collagen, a form of connective tissue, increases and forms cross-links that are associated with the animal age. Collagen cross-linking is observed in the whole muscle cuts and

results in less tender beef. The injection of a rinse solution through the carotid artery following exsanguination has been shown to improve tenderness. This solution can consist of water, glucose, maltose and phosphates and impacts tenderness by degrading collagen structure.

Experimental Procedures

Cows ($n = 28$) were randomly assigned to two treatments: non-rinsed control ($n = 14$) and a rinsed ($n = 14$) treatment, where a chilled isotonic solution (MPSC, Inc., St. Paul, MN) was rinsed through the carotid artery and veins following exsanguination. The isotonic solution consisted of water, glucose, maltose and phosphates. Both control and rinsed treatments were electrically stimulated. At two days postmortem, strip loins were removed from one side of each carcass. Strip loins were fabricated into 1-inch steaks at 3 days postmortem and objective color measurements (L^* (lightness), a^* (redness) and b^* (yellowness)) were recorded on a single steak from each loin after a thirty-minute bloom period. Steaks were vacuum packaged and aged at 39°F for 7, 14, and 21 days. Following aging, steaks were frozen (-4°F) for future analysis. Warner-Bratzler Shear Force (WBSF) was used to measure tenderness. Frozen steaks were thawed at 39°F for 24 hours before cooking. Steaks were cooked on an electric clamshell grill to an internal temperature of 160°F. Internal temperature was monitored on all steaks using a digital thermometer that was placed in the center of each steak. Peak cook temperature was recorded for each steak. Following cooking, steaks were cooled at 39°F and then allowed to equilibrate to room temperature (68°F). Six cores (0.5 inch) were removed from each steak and sheared perpendicular to the muscle fiber orientation. The peak force was recorded for each core and the average calculated for each steak. Data were analyzed using the MIXED procedure of SAS (SAS Inst. Inc., Cary, NC). Shear force data were analyzed as a repeated measure with time and treatment as fixed variables. Color data were analyzed as a completely randomized design using treatment as the fixed variable. Statistical significance was considered at an alpha of $P < 0.05$ and trends at $0.05 \leq P < 0.10$.

Results and Discussion

There was no interaction ($P = 0.6068$) between treatment and postmortem aging day (Figure 1). Steaks from the rinsed treatment were more tender ($P = 0.0005$), than steaks in the control treatment (7.74 ± 0.370 lbs and 9.72 ± 0.384 lbs, respectively). Postmortem aging influenced ($P = 0.0310$) tenderness. Steaks aged 7 days were less tender ($P = 0.0087$) than steaks aged for 21 days (9.22 ± 0.342 lbs and 8.20 ± 0.344 lbs, respectively), while 14-day steaks did not differ ($P > 0.05$) from those aged 7 or 21 days. Objective color was not impacted by rinse treatment ($P > 0.05$; Table 1).

Implications

A post-harvest circulatory rinse may be an efficacious methodology to be used in slaughter plants to impact tenderness and meat quality of cows.

Acknowledgements

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References

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 Cross et al. 1973. J. Food Sci. 38:998-1003
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| Table 1. Least squares means for color values of cooked striploin steaks from control and post-harvest rinsed cows. | | | | |
|---|----------------------|--------------------|------------------|-----------|
| Variable | CONTROL ¹ | RINSE ¹ | SEM ² | P - Value |
| L* | 38.95 | 39.29 | 0.8359 | 0.6897 |
| a* | 24.93 | 25.22 | 0.4599 | 0.5334 |
| b* | 10.73 | 10.67 | 0.3785 | 0.8789 |

¹Treatments: CONTROL (n=14); RINSE (n=14)

²Standard error of the mean

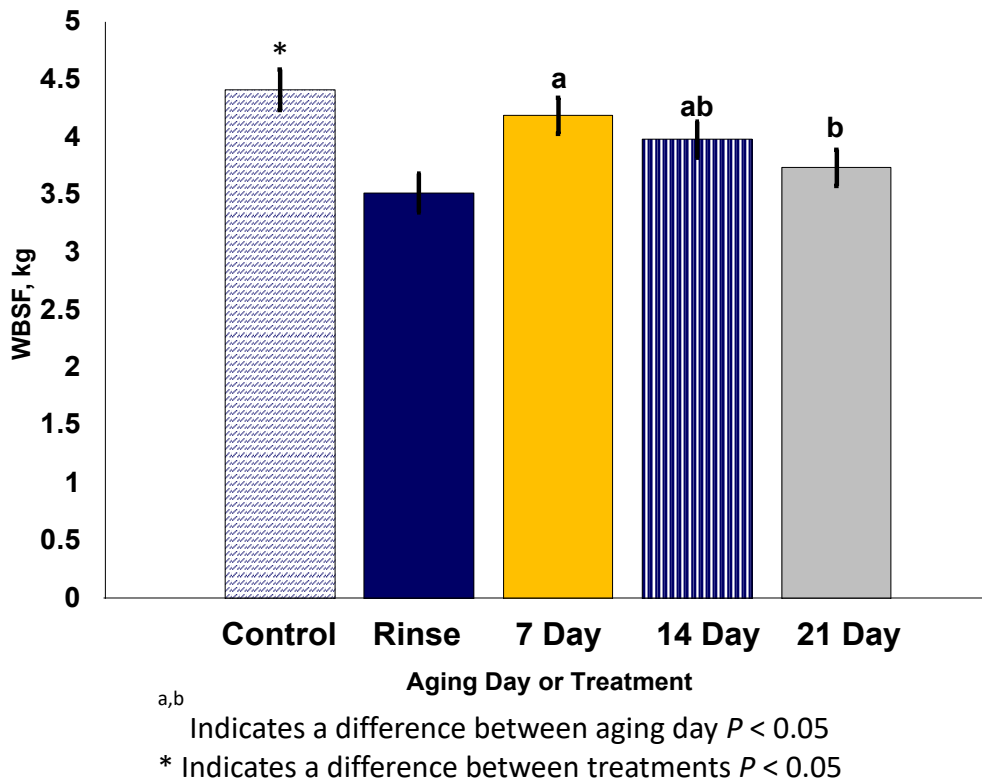


Figure 1. Means for Warner-Bratzler Shear Force values of cooked striploin steaks from control and post-harvest rinsed cows.