IMPACT OF NITRITE-EMBEDDED PACKAGING AND ENHANCEMENT ON DARK-CUTTING RAW AND COOKED BEEF COLOR

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I. OBJECTIVES

A greater than normal pH (> pH 6) provides a darker appearance upon blooming and a pink cooked internal color. Therefore, dark-cutting (DC) beef can be negatively perceived by consumers, resulting in a discount in carcass value. Novel nitrite-embedded packaging (NEP) has been shown to improve the redness of DC beef. However, the understanding of retail color stability, cooked color, and palatability of enhanced DC steaks stored in NEP and the effects repackaging in polyvinyl chloride (PVC) overwrap on retail color are limited. Therefore, the objectives of this study were to (1) determine the effects of NEP and enhancement on DC beef color, (2) investigate the impact of repackaging in PVC on the redness of DC beef, and (3) evaluate the effect of enhancement and packaging on cooked color and palatability.

II. MATERIALS AND METHODS

DC beef strip loins ($n = 8$; pH 6.39) and USDA Choice beef strip loins ($n = 6$; pH 5.56) were selected at a commercial packing plant. DC loins were divided into 2 sections and randomly selected as nonenhanced dark-cutting (DCNE) and enhanced dark-cutting (DCE) treatments with 110% pump of the green weight. From the enhancement, a final concentration of 0.5% glucono delta-lactone and 0.1% rosemary was in the loins. Steaks (1.91 cm) were removed from nonenhanced normal-pH, DCNE, and DCE loins with steaks randomly assigned to 3, 6, or 9 d in dark storage. Normal-pH and DCNE steaks were vacuum packaged, while DCE steaks were packed in NEP. All steaks were stored in dark storage until 3, 6, or 9 d and then repackaged in PVC and displayed for 6 d. During dark storage, instrumental color was evaluated every 24 h using a HunterLab MiniScan Spectrophotometer twice on the surface of the steak, and upon repackaging, instrumental and visual color ($n = 6$) was evaluated every 12 h. For objective 3, steaks for cooked color were placed in dark storage for 72 h after packaging the DCE steak in NEP and the DCNE and normal-pH steaks in vacuum packaging. A trained sensory panel ($n = 6$) evaluated sensory steaks for beef palatability. The data were analyzed using the Mixed Procedure of SAS (SAS Institute Inc., Cary, NC).

III. RESULTS

The DCE steaks had an increase ($P < 0.05$) in a^* value in 24 h of dark storage, aligning with an increase ($P < 0.05$) in nitric oxide myoglobin. Upon repackaging DCE steaks, nitric oxide myoglobin decreased ($P < 0.05$) during the first 12 h of display. The loss of nitric oxide myoglobin corresponded with a darker red appearance, increased surface discoloration, and decreased a^* values. The cooked DCE steaks had lower ($P > 0.05$) internal a^* values than cooked DCNE steaks, and panelists reported a decrease in internal redness for DCE steaks. However, the external cooked color of DCE had a pinker ($P < 0.05$) appearance than normal-pH and DCNE steaks. The sensory panel determined no difference in tenderness for all

treatments; however, DCE steaks had more detectable ($P < 0.05$) sour flavor than DCNE steaks.

IV. CONCLUSION

In conclusion, DCE steaks packaged in NEP improved surface redness during retail display. However, repackaging DCE steaks in PVC decreased color stability and redness of steaks within 12 h of the display. The enhancement decreased internal redness upon cooking, and palatability was impacted by the enhancement. The current research suggests that adopting appropriate packing and enhancement technology has the potential to increase the value of DC beef.

Keywords: dark-cutting beef, Freshcase®, meat color, myoglobin, nitrite packaging