Dark storage of enhanced dark-cutting beef in nitrite-embedded packaging increased metmyoglobin formation upon repackaging

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Introduction: Consumers prefer a bright-cherry red appearance of steaks in the grocery store. This appearance is achieved by the binding of oxygen to myoglobin when the steaks are in polyvinyl chloride (PVC) overwrap. Dark-cutting beef deviates from the bright cherry-red appearance resulting in a darker color and negative perception from consumers. Nitrite-embedded packaging (NEP) has been shown to improve redness and color stability of dark-cutting beef; however, there is limited understanding of color stability after using NEP and repackaging into PVC for retail.

Purpose: The objective was to evaluate novel NEP and enhancement effects on the color of dark-cutting beef after repackaging into PVC for display.

Methods: From a commercial packing plant, dark-cutting beef strip loins (n = 8; pH = 6.39) and USDA Low Choice beef strip loins (normal-pH, n = 6) were collected. Bisected dark-cutting loins were randomly assigned to nonenhanced dark-cutting (DCN) and enhanced dark-cutting (DCE) with glucono delta-lactone and rosemary. Steaks (1.91 cm) sliced from nonenhanced normal-pH, DCN, and DCE loins were randomly assigned to 3, 6, or 9 d in dark storage, and DCE steaks were packaged in nitrite-embedded packaging (NEP) with normal-pH and DCN steaks packaged in vacuum packaging. At dark storage d of 3, 6, or 9, steaks were repackaged in PVC and displayed for 6 d. Upon repackaging, the instrumental color was evaluated every 12 h, and metmyoglobin formation was calculated using the ratio of reflectance of 572 nm and 525 nm. Delta E was calculated to determine the change in color over time using the change in L^*, a^*, and b^* values from h 0 to h 12 of display. Data were analyzed using the Mixed Procedure of SAS, and least square means were considered significant at $P < 0.05$ and separated using the PDIFF option.

Results: Metmyoglobin formation increased ($P < 0.05$) within 12 h of repackaging DCE steaks held for 3 d and 6 d of dark storage. At h 12 of display, DCE steaks had significantly more metmyoglobin formation than DCN and normal-pH steaks. The ΔE of DCE steaks was negative, indicating a decline in color after 12 h of display, while the normal-pH and DCN steaks had a positive ΔE value indicating improved surface color.

Significance: The repackaging DCE steaks resulted in decreased color stability and increased metmyoglobin formation. However, NEP can improve color stability of dark-cutting beef when not remove from the NEP system.

Keywords: Meat color, dark-cutting beef, nitrite-embedded packaging