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Effect of Radiant Catalytic Ionization on Lean Color and Lipid Oxidation of Beef

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Objectives

The radiant catalytic ionization (RCI) technology utilizes a combination of UV light and low-level oxidizers such as ozone, hydroxyl radicals, and hydrogen peroxide to cause antimicrobial action. There is a potential to use this technology as an antimicrobial intervention against foodborne pathogens for meat. However, the use of UV light and oxidizers may accelerate the oxidation of pigments and lipid components of meat. Thus, the objective of this study was to evaluate the effect of RCI technology on the lean color and lipid oxidation of beef during storage period.

Materials and Methods

A total of 24 pieces of beef flanks (10 × 10 cm) were collected and surface-trimmed for lean color measurement, and another set of 24 pieces of beef flanks (10 × 10) were collected without being trimmed (external fat was left on) for lipid oxidation measurement. Half of each set of samples were exposed to RCI (UV intensity: 0.0042 J/cm^2 × exposure time in seconds, ozone level: 0.2 to 0.3 ppm, hydrogen peroxide: 0.15 to 0.2 ppm) for 75 s and the untreated samples were set as control. Samples were stored in Whirl-Pak bags at 4°C in the dark. Objective color and thiobarbituric acids reactive substances (TBARS) analyses were made on 0h, 24h, d 3, 7 and 14 of storage on the same pieces of meat. Only lean color were measured, and only surface fat of each meat sample was excised and tested for TBARS analysis.

Results

No interactive effect of treatment and storage time was identified ($P > 0.05$) on lean color and lipid oxidation. When averaged over all storage times, the lean L* and b* values were higher ($P < 0.05$) for RCI treated samples than for control samples, indicating that lean of RCI treated samples had a lighter, more yellow appearance. However, no difference ($P > 0.05$) was detected on lean a* value, suggesting that both control and treated samples appeared to have similar red color. In terms of lipid oxidation, the TBARS values did not differ ($P > 0.05$) for control and treated samples. Across all samples, the TBARS values increased ($P < 0.05$) as storage time increased, although the average TBARS value for samples on d 14 was 0.33 (± 0.06) mg malondialdehyde (MDA)/kg, which was lower than the minimal TBARS value for strong off-odor development to reject beef at 2 mg MDA/kg. No interactive effect of treatment and storage time was identified ($P > 0.05$) on lean color and lipid oxidation. Over all storage times, the lean L* and b* values were higher ($P < 0.05$) for RCI treated samples than for control samples, indicating that lean of RCI samples had a lighter, more yellow appearance. However, no difference ($P > 0.05$) was detected on lean a* value, suggesting that both control and treated samples appeared to be similar red color. In terms of lipid oxidation, the TBARS values did not differ ($P > 0.05$) for control and treated samples. Across all samples, the TBARS values increased ($P < 0.05$) as storage time increased, although the average TBARS value for samples on d 14 was 0.33 (± 0.06) mg malondialdehyde (MDA)/kg, which was lower than the minimal TBARS value for strong off-odor development to reject beef at 2 mg MDA/kg.

Conclusion

In conclusion, the use of RCI technology under current settings as an antimicrobial treatment, will not cause adverse effect on lean red color or accelerate the lipid oxidation of beef.

