



Effects of Packaging, Antioxidants, and NADH on Ground Beef Color and Oxidation Reduction Potential

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Keywords: beef color, metmyoglobin reducing activity, antioxidants, NADH
Meat and Muscle Biology 1(2):163

doi:10.221751/rmc2016.157

Objectives

Color is the most important indicator of freshness to consumers and drives their decision to purchase meat. Previous studies have indicated that lipid oxidation products can decrease activity of enzymes involved in NADH regeneration and metmyoglobin reduction. The objective of this study was to determine the effects of oil- and water-soluble rosemary and NADH on ground beef color and oxidation reduction potential (ORP) properties in polyvinyl chloride (PVC) and high-oxygen modified atmosphere packaging (HiOx-MAP).

Materials and Methods

Fresh course ground beef (81% lean) chubs were purchased on the day of preparation from a local retail store. Each chub was divided into twelve 100 g sections. Twelve treatments were randomly assigned to 100 g sections. Treatments included PVC and HiOx-MAP (80% oxygen and 20% carbon dioxide) controls (without added ingredients), NADH added patties in PVC and HiOx-MAP, oil- and water-soluble rosemary in PVC and HiOx-MAP with- and without NADH. The oil- and water-soluble rosemary were added at 0.2% and NADH was added as a positive control at 1 µg/g of ground beef. Following ingredient addition, each 100 g section was mixed for 30 s, fine ground, and formed into a patty (thickness 1.4 cm, diameter 10.5 cm). All patties were placed in dark for 24 h at 2°C, then displayed under continuous fluorescent

lighting (retail display) at 4°C for 3 d. Surface color (a* value) of all the patties were taken on d 0, 1, 2, and 3, of display using a Hunter Lab Miniscan EZ spectrophotometer. Thiobarbituric acid assay (TBARS) for lipid oxidation and ORP were measured on the day of preparation, 0, and 3-d display. The experiment was replicated 6 times and the data were analyzed using the Mixed Procedure of SAS (SAS Inst. Inc., Cary, NC) and the significance was determined at $P < 0.05$.

Results

There was a significant packaging by ingredients interaction for surface redness (a* values), TBARS values, and ORP. Oil-soluble rosemary with NADH had less discoloration ($P < 0.05$; d 2 a* value = 23.8 ± 0.8) than other treatments. Water- and oil-based rosemary in combination with NADH had greater ($P < 0.05$) red color than NADH alone. NADH was used as a positive control to donate electron for metmyoglobin reduction. Addition of water- and oil-soluble rosemary increased ($P < 0.05$) ORP, but not NADH ($P > 0.05$). Patties packaged in HiOx-MAP had a lower reduction potential than PVC packaging. Oxidation reduction potential (ORP) measures the net balance between total oxidants and total reductants in a biological system.

Conclusion

The current research indicates that limiting lipid oxidation will help to utilize NADH more efficiently for improved color stability and MRA.