



## Modified Atmosphere Packaging Systems Influence Myoglobin Oxidation of Ground Beef in Led and Fluorescent Lighting

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**Keywords:** ground beef, lighting, modified atmosphere packaging, myoglobin, oxidation  
Meat and Muscle Biology 1(2):24

doi:10.221751/rmc2016.023

### Objectives

Color is the most important factor in decision making for the consumer in the retail setting. The objective of this study was to determine the color stability of ground beef patties under three different retail lighting conditions in three different packaging types.

### Materials and Methods

USDA Choice chuck rolls were first ground through a coarse 10 mm plate and then reground through a fine 4.5 mm plate and then formed into 27 patties (113.4 g). Patties were then assigned into one of three packaging treatments: HO<sub>2</sub>-MAP (80% O<sub>2</sub>; 20% CO<sub>2</sub>), LO<sub>2</sub>-MAP (20% O<sub>2</sub>; 20% CO<sub>2</sub>; 60% N<sub>2</sub>), or overwrap with polyvinyl chloride (PVC). Then each packaging type was then assigned to deli cases (5°C) with one of three retail lighting conditions: low-UV fluorescent bulbs (FLO) with an average lux of 244, light emitting diode (LED) with an average lux of 732, and no light (DRK). Patties were removed on storage d 1, 3, 7, 10, and 14 for analysis of L\* a\* b\*, lipid oxidation by thiobarbituric acid reactive substances (TBARS), and percentage of myoglobin states. The entire experiment was replicated three times. Data was ran using the GLIMMIX function of SAS and significance was determined at  $P < 0.05$ .

### Results

There was an interaction between package type and storage day for L\* ( $P < 0.0001$ ). Patties packaged in HO<sub>2</sub>-MAP had an increase ( $P < 0.05$ ) in L\* through storage day but were similar to each subsequent day. L\* increased ( $P < 0.05$ ) on storage d 3, 7, and 10 for patties packaged in LO<sub>2</sub>-MAP. PVC patties had increase ( $P < 0.05$ ) in L\*

from storage d 7 to 10. Patties packaged in HO<sub>2</sub>-MAP and LO<sub>2</sub>-MAP had higher ( $P < 0.05$ ) L\* values on storage d 3, 7, 10, and 14 than PVC. Package type had an affect ( $P < 0.0001$ ) on a\* where HO<sub>2</sub>-MAP > LO<sub>2</sub>-MAP > PVC, with averages on 15.88, 14.34, and 12.63, respectively. Lighting type also had an affect ( $P = 0.0005$ ) on a\* where DRK = FLO > LED, with averages of 15.32, 14.31, and 13.22, respectively. There was a decrease ( $P < 0.0001$ ) in a\* throughout storage day, 1 > 3 > 7 > 10 > 14, with averages of 23.56, 19.56, 12.98, 8.70, and 6.70, respectively. Lighting type did not affect ( $P = 0.1045$ ) TBARS. TBARS decreased ( $P < 0.0001$ ) throughout storage day where 1 < 3 < 7 < 10 < 14, with averages of 0.58, 0.98, 1.67, 2.60, and 4.07, respectively. Packaging had an effect on oxy-myoglobin (OMb;  $P = 0.0012$ ) where HO<sub>2</sub>-MAP = PVC > LO<sub>2</sub>-MAP (51.61, 50.84, and 49.45, respectively) and metmyoglobin (MMb;  $P = 0.0025$ ) where LO<sub>2</sub>-MAP > HO<sub>2</sub>-MAP = PVC (47.21, 43.92, and 45.16, respectively). Oxy-myoglobin values were impacted by storage day where storage d 1 = 3 > 7 > 10 = 14, with averages of 55.68, 54.6, 50.45, 46.48, and 45.95, respectively. Deoxy-myoglobin (DMb) followed the same trend with storage d 1 = 3 > 7 > 10 = 14, with averages of 6.45, 6.33, 3.87, 1.63, and 1.42, respectively. Inversely, MMb increased over time with storage d 1 = 3 < 7 < 10 = 14, with averages of 37.87, 39.07, 45.68, 51.89, and 52.65, respectively. There were no differences between lighting type on OMb ( $P = 0.2410$ ), DMb ( $P = 0.5229$ ), or MMb ( $P = 0.2736$ ) percentages.

### Conclusion

The use of HO<sub>2</sub>-MAP in retail settings will increase redness in ground beef patties regardless of lighting source, indicating that a movement toward LED lights in the retail setting will not be detrimental to discoloration in products packaged in HO<sub>2</sub>-MAP.