



## Impact of Novel Light Sources on Color and Flavor Oxidation of Beef

J. Cooper<sup>1\*</sup>, B. R. Wiegand<sup>1</sup>, A. B. Koc<sup>2</sup>, L. Schumacher<sup>1</sup>, and C. L. Lorenzen<sup>1</sup>

<sup>1</sup>University of Missouri, Columbia, MO, USA; <sup>2</sup>Clemson University, Clemson, SC, USA

**Keywords:** color, ground beef, lighting, myoglobin, oxidation  
Meat and Muscle Biology 1(2):110

doi:10.221751/rmc2016.107

### Objectives

Meat color is considered to be one of the driving factors in consumer purchasing decisions. The objective of this study was to determine the impact of two different lighting sources on color and lipid oxidation of ground beef patties in a controlled environment.

### Materials and Methods

Select quality grade top rounds with necessary subcutaneous fat ( $n = 20$ ) were coarse ground through a 10 mm grinding plate and finely ground through a 4.5 mm grinding plate to produce ground beef at 2 different fat levels (5 and 25%) and made into patties (113.4 g). Patties were packaged with oxygen permeable polyvinyl chloride and assigned to 1 of 3 lighting treatments (low UV fluorescent [FLO], Light Emitting Diode [LED], and no light [negative control]) within temperature controlled (5°C) deli cases. Patty removal for evaluation occurred on storage d 1, 3, 5, and 7. Objective color measurements were obtained using a Hunter MiniScan. These values were utilized to determine relative myoglobin variant concentrations as a measure of myoglobin oxidation. Additionally, thiobarbituric acid reactive substances (TBAR) were run to determine lipid oxidation. Means were separated using the GLIMMIX function of SAS (SAS Inst. Inc., Cary, NC) with fixed effects of light source, fat percentage, and storage day. Significance was determined at  $P < 0.05$ .

### Results

Objective color measurement for  $a^*$ , decreased for all light treatments by storage day ( $P < 0.0001$ ) where storage

d 1 > 3 > 5 > 7, respectively. Mean  $a^*$  values for both fat percentages decreased over time where storage d 1 > 3 > 5 > 7, respectively. Patties containing 5% fat were redder ( $P < 0.05$ ) as indicated by  $a^*$  values than those containing 25% fat on storage d 1, 3, and 7; the exception being storage d 5 having no differences ( $P > 0.05$ ) in  $a^*$  values between fat levels. Oxymyoglobin ( $MbO_2$ ) values for all light treatments decreased daily but showed no differences between treatments until d 5 ( $P < 0.0001$ ) where no light > LED > FLO. Inversely, metmyoglobin (MMb) values increased daily ( $P < 0.0001$ ) but showed no differences between light treatments until d 5 where FLO > LED > no light. Oxymyoglobin values for both fat percentages decreased daily with differences occurring on storage d 7 with 5% fat patties having a greater percentage of  $MbO_2$  (53.71) than 25% patties (52.43). Metmyoglobin values increased daily for patties of both fat percentages with differences occurring on d 7 of storage ( $P < 0.05$ ) with 25% fat patties having a greater percentage (45.28) of MMb than 5% fat patties (44.14). TBAR values increased with increasing storage day for both fat percentages ( $P < 0.0001$ ). After storage d 1 ( $P > 0.05$ ), lower mean values occurred ( $P < 0.05$ ) on storage d 3, 5, and 7 for patties with 25% fat than those of 5% fat. Indicating greater amounts of lipid oxidation occurred within the phospholipid membrane than that of added subcutaneous fat.

### Conclusion

This study indicates that light treatment influences discoloration, MMb formation, and lipid oxidation of ground beef patties at the end of retail shelf life, indicating that LED lights may be beneficial to retailers by adding additional retail storage days.