



## Correlation Among Ground Beef Lipid Content, Color, and Lipid Oxidation Over a 7-Day Simulated Retail Display Period

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**Keywords:** color, correlation, ground beef, lipid oxidation  
Meat and Muscle Biology 3(2):63

### Objectives

Ground beef is more susceptible to lipid oxidation compared to whole muscle beef cuts. This is due to its smaller particle size and greater surface area, which makes the meat products more prone to be exposed to various environmental factors during production. The objective of this study was to determine the relationships among ground beef lipid content, instrumental color, visual discoloration, and lipid oxidation over a 7d simulated retail display period.

### Materials and Methods

Beef inside rounds (IMPS #168) from the right sides of steer carcasses ( $n = 63$ ) were collected from a commercial processing facility and delivered to the U of Guelph Meat Science Laboratory for further analyses. Each inside round was trimmed of all subcutaneous fat and connective tissue, and then fabricated into ground beef patties (113 g/patty) at two targeted fat addition levels (no added fat and 25%). Lean ground beef (no added fat) was made by grinding cubes of inside round muscle through a Sirman Master 90 Y12 meat grinder (Sirman USA, Franklin Park, IL). Regular ground beef (25% added fat) was made by grinding cubed round muscle with an additional 25% subcutaneous fat that originated from the rib primal of the same carcass. For the simulated retail shelf life study, 2 crust frozen patties (crust frozen for 1 h to improve packaging ability) were placed on a Styrofoam meat tray with a soaker pad and overwrapped with PVC film. In total, there were 4 trays of patties per ID (2 trays/targeted fat level). Trays were placed under two LED lights (52 W, 1850 lumens, color temperature of 4000K, 1612.5 to 2152 lux) at 4°C and the locations on shelves were changed every 24 h.

Minolta L\*, a\*, b\* color and subjective surface discoloration were evaluated every 24 h for 7 d. Lipid peroxidation of patties before and after the retail display was estimated using thiobarbituric reactive substances (TBARS; mg MDA/g fat). Lipid content of patties was quantified using Soxhlet extraction with petroleum ether. Summary statistics and Pearson correlation coefficients were determined using the PROC CORR procedure of SAS. Correlations were regarded as weak at  $r < |0.35|$ , moderate at  $|0.36| \leq r \leq |0.67|$ , and strong at  $r \geq |0.68|$ .

### Results

Lipid content in the 126 ground beef samples evaluated in this study ranged from 3.47% to 30.43% ( $16.30\% \pm 6.18\%$ ). A moderate and significant correlation was observed between lipid content and change in TBARS values ( $r = -0.59$ ,  $P < 0.0001$ ). Similarly, an increase in lipid content is moderately correlated with a decrease in a\* values ( $r = -0.58$ ,  $P < 0.0001$ ) and an increase in surface discoloration after a 7d display period ( $r = 0.53$ ,  $P < 0.0001$ ).  $\Delta$  TBARS values was weakly correlated with  $\Delta$  L\* ( $r = 0.24$ ,  $P < 0.01$ ),  $\Delta$  a\* ( $r = 0.11$ ,  $P = 0.25$ ), and visual discoloration ( $r = -0.16$ ,  $P = 0.09$ ). Finally,  $\Delta$  a\* was strongly correlated with surface discoloration values at d7 ( $r = -0.76$ ,  $P < 0.0001$ ).

### Conclusion

An increase of lipid content in ground beef had a moderate association with decreased redness, greater surface discoloration, and less change in lipid oxidation over a 7d simulated retail display period. Color values were not great predictors of lipid oxidation values and trained technicians often equated visual discoloration in beef to a deviation from the desired cherry red color.