

# ETERMINING BEEF *LONGISSIMUS LUMBORUM* STEAK COLOR LIFE THRESHOLD AND EFFECT OF POSTMORTEM AGING TIME USING META-ANALYSIS

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## I. OBJECTIVES

The study objective was to determine the color life threshold for *longissimus lumborum* (LL) steaks during retail display and the effect of postmortem (PM) aging time on the display color life of LL steaks using meta-analysis.

## II. MATERIALS AND METHODS

This meta-analysis was divided into 2 phases: (1) threshold determination and (2) the PM impact on display color life of steaks. (1) To estimate the color threshold in phase 1, *a\** redness using illuminant A and subjective visual score data from 14 referred journal articles, published from 2000 to 2020, with a total of 22 experiments and 153 observations, were used. Visual scores from each experiment were standardized to an 8-point line scale in which 1 = very bright red, 2 = bright red, 3 = dull red, 4 = slightly dark red, 5 = moderately dark red, 6 = dark red to tannish red, 7 = dark reddish tan, and 8 = tan to brown—which is the recommended AMSA guideline (AMSA, 2012). Previously, others have found that a discoloration score of 4.75 was borderline for color acceptability for beef aerobically packaged LL steaks during simulated retail display. This value was used to estimate the confidence intervals for the *a\** redness threshold for display color life of LL steaks. The MIXED procedure of SAS version 9.4 (SAS Institute Inc., Cary, NC) was used to estimate the display color life threshold of steaks. Data were analyzed using the linear mixed model with visual color scores being the independent variable (fixed effect). Using a confidence interval of 95%, *a\** redness threshold was calculated. In phase 2, data from 23 referred journal articles were used, totaling 35 experiments with 237 observations. PM aging times and *a\** redness score values were used in this phase of the analysis. PM aging times were grouped into 7 categories: 0–7 d PM = 7 d PM; 8–14 d PM = 14 d PM; 15–21 d PM = 21 d PM; 22–28 d PM = 28 d PM; 29–35 d PM = 35 d PM; 36–42 d PM = 42 d PM; and 43–62 d PM = 62 d PM. Data were analyzed using the linear mixed model with visual color scores being the independent variable (fixed effect). Intercepts and the slope of each experiment were assumed to be normally distributed with variance-covariance matrix of type “unstructured.” To account for heterogeneous errors, the inverse of squared SEM was used with the WEIGHT statement for the 2 phases.

## III. RESULTS

For phase 1, the estimates for *a\** redness as a borderline for the display color life of LL steaks were 22.92 for the estimate, and 24.98 and 20.92 for the higher and lower bounds, respectively, using a 95% confidence interval. Using the lower bound value as the threshold for borderline acceptability, the display color life was estimated for the 7 d PM aging time groups for the second phase. Steaks up to 21 d PM had the longest display color life of 7 d,

while steaks that were 22–28 d PM had a display color life of 4 d. For PM d 29–35, 36–42, and 42–62, the display color life of LL steaks was 3, 2, and 2 d, respectively.

#### IV. CONCLUSION

Knowing the PM age of LL subprimals could serve as a tool for retailers to identify the potential display color life of LL steaks displayed under aerobic packaging conditions. Estimations from this meta-analysis demonstrate that using LL subprimals having a PM age of 21 d or less would maximize retail display color life of aerobically packaged steaks.

Keywords: beef, color life, meta-analysis