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Correlation of Computer Vision System Data with Traditional Methods of Evaluating Pork Color and Marbling on the Ventral Side on the Whole Loin and on Individual Loin Chops

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Objectives

Pork quality is a combination of many different attributes, including color, intramuscular fat percentage (IMF), pH, drip loss, and tenderness. Currently, in the pork industry, color and marbling of the whole loins are commonly assessed subjectively by a trained evaluator according to the National Pork Board's color and marbling standard cards. However, subjective color (SCS) and marbling (SMS) scores can be influenced by lighting and evaluator fatigue. Colorimeters are a common technology that are utilized for measurement of color in the meat industry but have their limitations as they only measure a small portion of the surface and cannot separate lean and fat tissue. Ether extract is commonly used for crude fat determination, but it requires a longer time for analysis and a sample that will be consumed by the process. Computer vision system (CVS) is a technology that has been applied in the food industry and is a non-invasive, efficient, and consistent method. Therefore, the objectives of this study were to compare pork color and marbling measured from the whole loin versus its individual chops and to compare the results from different pork quality measurement methods on the same sample.

Materials and Methods

Whole pork loins (n = 1400) were obtained from 6 major pork processing plants, with SCS, SMS, Hunter L, a, and b, and CVS images being collected on the ventral side of the loin in the plant. Samples were vacuum packed, shipped, and stored at 4°C for 14 d. Then whole loins were sliced into chops and the third (A) and 10th (B) rib chops were evaluated for SCS and SMS after a 10 min bloom. After SCS and SMS evaluation, Hunter L, a, and b, and CVS images were collected. The A and B chops were vacuum packaged, shipped, trimmed, freeze dried, and then evaluated for crude fat percentage (CF%) using ether extract method. The CF% of the whole loin was estimated as the average of the A and B chops. From the CVS images, lean and fat pixels were segmented to estimate L*, a*, and b* of the lean tissue and CVS IMF.

Results

A lower L* was found for both CVS and colorimeter when evaluating the whole loin (63.06 & 53.63, respectively) compared to the average of A and B chops (68.65 & 58.10, respectively). However, for SCS, individual chops, on average, were darker than the whole loin (2.88 vs. 2.67, respectively). Of all color measurements, Hunter L had the highest correlation when comparing the whole loin to A and B chops (r = 0.72 and 0.72, respectively). When comparing marbling results of the whole loin to the A and B chops, a moderate correlation was found using both SMS (r = 0.67 and 0.60, respectively) and CVS IMF (r = 0.52 and 0.54, respectively). When comparing methods, CVS L* had a stronger correlation with Hunter L than SCS for the whole loin and A and B chops. (r = 0.40 vs. 0.34, 0.82 vs. 0.47, and 0.84 vs. 0.40, respectively). For IMF, SMS had a stronger correlation with CF% than CVS IMF (r = 0.48 vs. 0.34, 0.62 vs. 0.39, and 0.54 vs. 0.38, respectively).

Conclusion

These results show great potential for CVS to be used in evaluating pork quality, specifically color and marbling. Additionally, it is possible to predict individual chop color and marbling based on the ventral side of the loin. Further research should be conducted to look at more technologies that can predict pork quality attributes.