EFFECTS OF MARBLING AND BLOOM TIME ON CIE L*, a*, AND b* VALUES OF PORK LOINS DURING 3-h OF BLOOM

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Abstract – Visual marbling level (VML) and bloom time (BT) effects on CIE L*, a*, and b* values of pork loin chops were investigated during 3-h BT. For each of five replications, nine pork loins were visually evaluated 24-h postmortem and categorized into low, medium, and high marbling. Color measurement was performed on chop surface initially and at every 15-min. Among the samples, pH was similar (p>0.05), but crude fat differed (p<0.05). VML*BT had no effect on L* (p>.05), but affected a* and b* (p<.05). High VML was the most lighter (p<.05). L* value stabilized during 90-min, but a* and b* stabilized after 15-min. All parameters increased (p<.05) after 165- min. At least 30-min BT is suggested before color assessment.

Key Words – intramuscular fat, muscle pigment oxygenation, instrumental color

I. INTRODUCTION

The bright pink bloom color or oxymyoglobin on pork chop cut surface is preferred by consumers [1]. Marbling is known to influence pork palatability and preferred by some groups of consumers, but can be considered unhealthy for others [2]. Industries are interested in producing pork with high marbling to improve palatability. But the information on marbling influence on pork bloom color and its retail stability is not commonly available. Many studies showed the evidence for an interaction between lipid and myoglobin oxidation processes in meat, but lack of clear evidence between the two oxidative reactions was also reported [3]. Time of myoglobin exposure to oxygen or bloom time (BT) can affect muscle surface bloom color [1]. Meat color evaluation in some industries and researches was performed after 1 h BT with variation in measuring times among the samples. The effect of visual marbling level (VML) and BT on CIE L*, a*, and b* [4] values of pork loin (*Longissimus dorsi*, LD) chops during 3 h of bloom was investigated.

II. MATERIALS AND METHODS

For each of five replications, nine boneless pork LD muscles were obtained from left side of Duroc castrated male carcasses (110.0±10 kg slaughter weight). At 24-h postmortem (PM), each LD was fabricated, evaluated on the 10th rib, and categorized into low (LM, score=1 or 2), medium (MM, score=3 or 4), and high (HM, score=5 or 6) VML [5]. LD was vacuum-packaged and placed in styrofoam containers with ice, transported to Meat Technology Research Network Center, KMITL and stored in a walk-in cooler. At 48-h PM, each LD was evaluated for pH value and a 2.5-cm thick chop was obtained approximately 18 cm from the muscle posterior end. Each chop was placed on a styrofoam tray and immediately overwrapped with polyvinyl chloride film (300,000 cm^3 O_2/µm/m^2/day/23ºC/ 0%RH). Initial surface CIE L*, a*, and b* value measurement was performed immediately after overwrapping (Illuminant D65, 10º standard observer, 2.5-cm aperture, MiniScan EZ, Hunter Associates Laboratory, Inc., USA). Each tray was then placed in an opened-top display case at 3.6±0.6ºC (Systemform, Thailand) and protected from light. Color measurement was performed every 15 min after initial measurement during 3 h of air exposure. Crude fat was determined from frozen (-20°C) chops. Data were analyzed as a randomized complete block design with repeated measures using ANOVA methods with the mixed procedure [6].

III. RESULTS AND DISCUSSION

No difference (p>0.05) in pH values (5.60-5.68) was observed. Crude fat differed (p<0.05) among the samples (LM=2.55%, MM=4.03%, and HM=6.11%). For CIE L* (lightness) values (Fig. 1), no combined effect (p=.099) of VML and BT was found. HM was the most lighter (54.8, p<.05) compared to MM (53.4) and LM (53.7). This is expected as fat contributed to light reflectance. BT main effect (represented by a thick line in Fig. 1) influenced (p<.05) CIE L*. During 90-min, lightness values did not differ (p>.05), but slightly increased (p<.05) at 105-min, then tended to be stable until 165-min BT. No effect of BT on L* values were reported during 30-min BT observed by others [1, 7]. The influence of BT on L* observed in our study can be due to a longer BT up to 3-h we examined, as shown by an increased L* value (p<.05) at 180-min. There was a combined effect (p<.05) of VML and BT on CIE a* (redness to greenness, Fig. 2) and CIE b* (yellowness to blueness, Fig. 3). Both a* and b* increased (p<.05) during the first 15 min, then stabilized until 165 min, where they much increased (p<.05). At 15-min, HM was redder (higher a*, p<.05) than LM, but similar to MM (p>.05). After 15-min, no difference (p>.05) in a* was found among the samples. For CIE b*, HM was initially more (p<.05) yellow than MM and LM, then remained similar

(p>.05) at 15-min until 165-min. At 180-min BT, HM was (p<.05) slightly more yellow than MM and LM. The stabilization of a* and b* values after 10-min BT [1] and after 18-min BT [7] were reported in pork.

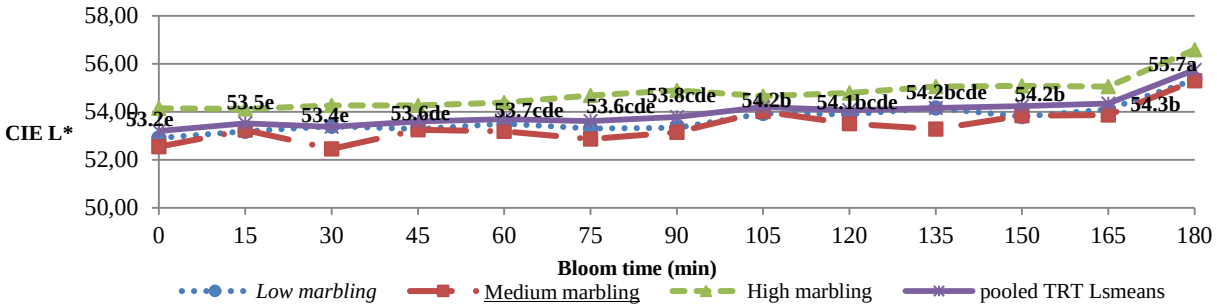

Fig. 1- Effects of marbling level and bloom time on CIE L* values of pork loin chop during 3 h of bloom. The thick line represents bloom time main effect. a, b, c, d, e Least square means with different letters differ (p<.05).

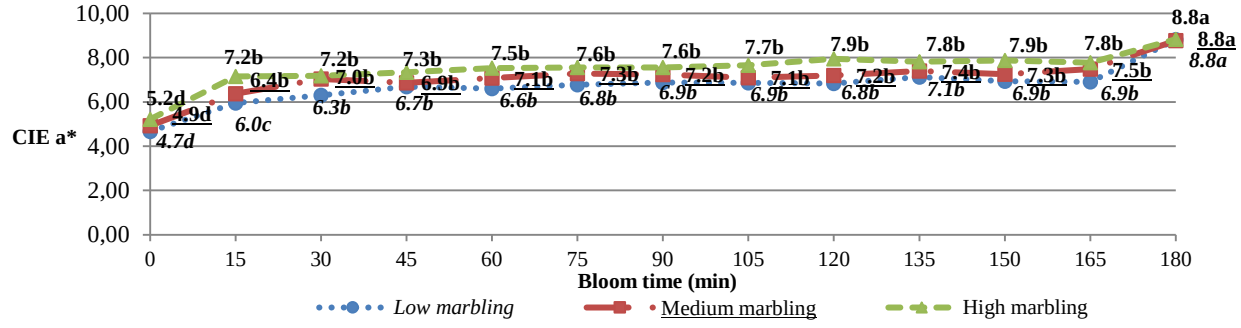

Fig. 2 - Effects of marbling level and bloom time on CIE a* values of pork loin chop during 3 h of bloom. a, b, c, d Least square means with different letters differ (p<.05).

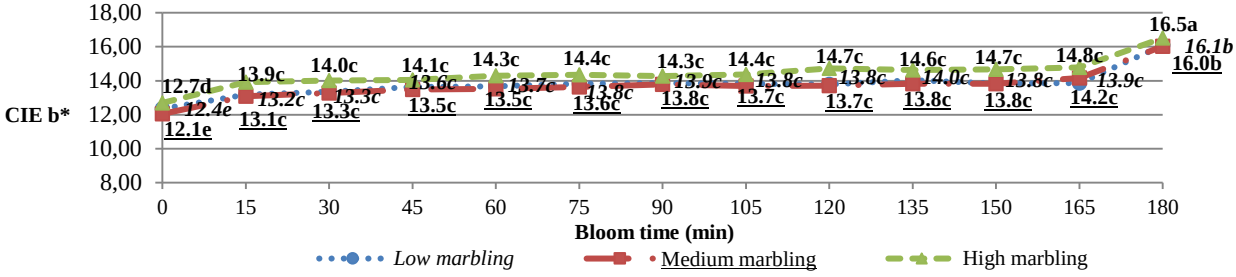

Fig. 3 - Effects of marbling level and bloom time on CIE b* values of pork loin chop during 3 h of bloom. a, b, c, d,e Least square means with different letters differ (p<.05).

IV. CONCLUSION

High marbling pork appeared lighter during 3-h blooming and seemed to be slightly more yellow and redder. Marbling may play more roles on color stability during extended display. To measure bloom color in pork with different marbling level, based on CIE L*, a*, and b* values, a bloom time of at least 30 min is suggested. If measuring time exceeds 1-h, color assessment should be done during 60-90 min as all three parameters tend to be stabilized.

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