Pulmonary Arterial Pressure in Fattened Angus steers at Moderate Altitude Influences Beef Color during Retail Display

Chaoyu Zhai [1], Robert J. Delmore [1], Ifigenia Georgnaras [1], Scott E. Speidel [1], Tim N. Holt [2], Milton G. Thomas [1], R. Mark Enns [1], Mahesh N. Nair [1]

[1] Department of Animal Sciences, Colorado State University, Fort Collins, 80523, United States
[2] Department of Clinical Sciences, Colorado State University, Fort Collins, 80523, United States

Introduction:

- Pulmonary hypertension (PH) is a noninfectious disease of cattle. It can occur at altitudes > 1524 m (HAD = High Altitude Disease) and also at moderate altitudes (800-1500 m) in fattening cattle (FHD = Feedlot Heart Disease).
- Phenotypes of PH are distension of the jugular vein, dyspnea, ascites, and brisket edema, and heart failure. Pulmonary arterial pressures (PAP; > 50 mmHg) is used as an indicator of PH.
- Meat color is a quality attribute that critically influences consumer purchasing decisions.
- **Objective of this study was to examine the effect of pulmonary arterial pressures (PAP) on postmortem beef color during retail display.**

Materials and Methods:

- Strip loin (*longissimus lumborum*; LL) steaks from high (98±13; n = 5) and low PAP score (41±3; n = 6) Angus steers weaned and fed at moderate altitude were collected postmortem.
- Instrumental color, metmyoglobin reducing activity (MRA), and lipid oxidation of LL steaks were evaluated during simulated retail display days (1, 3, 5, 7, and 9).
- Color was measured using HunterLab MiniScan spectrophotometer whereas lipid oxidation was measured using thiobarbituric acid reactive substances (TBARS) assay.
- A split-plot design was used to analyze the effects of PAP score and display day on instrumental color, MRA, and lipid oxidation.
- PAP score (high or low), display day, and their interactions were the fixed effects, and random effect was individual steer.
- Differences between least square means ($P < 0.05$) were determined by Tukey's multiple comparisons.

Results:

Table: Lightness (*L** value), redness (*a** value), yellowness (*b** value), chroma, hue, MRA, and lipid oxidation (TBARS) of beef *longissimus* steaks from animal with high or low mPAP score during display (n = 5 for low mPAP; n = 6 for high mPAP).

Parameter	mPAP Score	Display Day					SE
		1	3	5	7	9	
*L** value	High	41.5 a#	38.9 b	40.1 ab	39.9 ab	40.4 ab	1.09
	Low	41.4	41.6	41.5	41.8	42.4	0.99
*a** value	High	18.6 a,x	17.3 ab,x	17.3 ab,x	16.6 b,x	13.5 c,x	0.60
	Low	18.7 a,x	18.0 ab,x	18.1 ab,x	17.6 ab,x	16.6 b,y	0.55
*b** value	High	13.9 a	12.7 bc	13.3 ab	12.7 bc	11.7 c	0.45
	Low	14.1 a	13.7 ab	13.8 ab	13.4 ab	13.0 b	0.41
Chroma	High	23.2 a,x	21.5 ab,x	21.9 ab,x	20.9 b,x	17.9 c,x	0.72
	Low	23.4 a,x	22.6 ab,x	22.8 ab,x	22.1 ab,x	21.1 b,y	0.66
Hue	High	53.2 a,x	53.8 a,x	52.5 a,x	52.7 a,x	48.8 b,x	0.60
	Low	52.9 a,x	52.6 a,x	52.6 a,x	52.6 a,x	51.9 a,y	0.55
% MRA	High	53.30 a,x	46.54 a,x	26.10 b,x	15.51 bc,x	3.43 c,x	7.43
	Low	55.49 a,x	43.39 ab,x	49.24 a,y	27.67 bc,x	21.52 c,x	6.79
TBARS	High	0.163 a	0.223 ab	0.305 ab	0.353 b	0.358 b	0.06
	Low	0.164	0.164	0.246	0.284	0.286	0.06

Least square means for the same trait in a column without a common letter (x-y) differ ($P < 0.05$). Least square means in a row without a common letter (a-c) differ ($P < 0.05$).

- An interaction ($P < 0.05$) between PAP score and display day for redness (*a** value), chroma, hue, and MRA was observed.
- There was no difference in color attributes, MRA, and lipid oxidation between the high and low PAP score groups on day 1.
- However, the LL steaks from high PAP score animal had lower ($P < 0.05$) redness (*a**), chroma, and hue than from low PAP score steer on day 9.
- A main effect ($P < 0.05$) of display day on lipid oxidation of was observed, with lipid oxidation increasing as display days increased.

Conclusions:

The results of current study indicated that the LL steaks from Angus steers fed at moderate altitude and with high PAP score have lower color stability than those from steers with low PAP score during simulated retail display.

Acknowledgement:

Research was partially supported by USDA-NIFA grant: *2018-67015-28241*.