



Effects of High Oxygen (Hiox) Modified Atmosphere Package (Map), Ultimate pH (Phu) and Enhancement with Potassium Lactate on Lipid Oxidation of Longissimus Lumborum from Nellore Bulls

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Keywords: injection, TBARS, shelf-life
Meat and Muscle Biology 1(2):28

doi:10.221751/rmc2016.027

Objectives

Beef storage in HiOx packages has been associated with quality loss due to lipid oxidation. However, steaks stored in HiOx have a thicker layer of oxymyoglobin, which has bright-red color desirable by consumers. So, the objective of this preliminary study was to assess the effect of 80% O₂/20% CO₂ atmosphere on lipid oxidation of beef enhanced with a potassium lactate solution and with three pHu ranges, during 14-d display-time.

Materials and Methods

Fifteen Nellore bulls, raised in a pasture fattening regime, with 36 mo were slaughtered in a conventional slaughterhouse. Thirty *Longissimus lumborum* muscles (LL) were divided into 3 pHu ranges (48h post-mortem): low (5.40 to 5.79), intermediate (5.80 to 6.19) and high (> 6.2). Half of each range ($n = 5$) were enhanced with lactate (potassium lactate, 2.5%; sodium tripolyphosphate, 0.3%; sodium chloride, 0.3%; rosemary aqueous extract, 0.06%), with about 8.2% pump gain. All muscles were cut into 2.5 cm steaks, which were packaged in 80% O₂/20% CO₂ atmosphere and stored at $2 \pm 1^\circ\text{C}$ under dark conditions until d 5 and under fluorescent light onward (1980 ± 150 lux). On d 0, 5, and 14 of retail display, pH, gas composition and lipid oxidation were determined. pH was measured with a pH-meter with a puncture electrode. Gas composition was measured with a headspace O₂/CO₂ analyzer. Lipid oxidation was analyzed by spectrophotometric measurement of the thiobarbituric acid reactive substances (TBARS), according to the method of Vynche (1970, 1975) and Sørensen and Jørgensen (1996), in triplicate.

Results

The pH measurements showed difference between enhanced (pH: 5.92 ± 0.03) and control groups (5.78 ± 0.03 , $p < 0.05$), without any difference during storage time for each pHu range. There was O₂ reduction in tray headspace as CO₂ proportion increased for all pHu ranges and treatments ($p < 0.05$). Enhanced muscles showed less lipid oxidation than the control group ($p < 0.05$). The interaction between pHu ranges and display-time for lipid oxidation are showed in Table 1.

Conclusion

These findings suggest that lipid oxidation can be reduced in LL with the injection of a potassium lactate solution to extend beef display-time.

Table 1. Effects of lactate injection-enhancement, pHu ranges and display retail time on TBARS values (mg MDA/kg beef) for beef steaks packaged in HiOxMap

Treatment	pHu	Day 0	Day 5	Day 14
Lactate	Low	$0.02 \pm 0.03^{\text{ax}}$	$0.07 \pm 0.03^{\text{ax}}$	$0.15 \pm 0.03^{\text{ay}}$
	Intermediate	$0.02 \pm 0.03^{\text{ax}}$	$0.02 \pm 0.03^{\text{ax}}$	$0.09 \pm 0.03^{\text{axy}}$
	High	$0.02 \pm 0.03^{\text{ax}}$	$0.03 \pm 0.03^{\text{abx}}$	$0.05 \pm 0.03^{\text{abx}}$
Control	Low	$0.16 \pm 0.03^{\text{abx}}$	$0.19 \pm 0.03^{\text{abx}}$	$0.35 \pm 0.03^{\text{by}}$
	Intermediate	$0.09 \pm 0.03^{\text{ax}}$	$0.16 \pm 0.03^{\text{abx}}$	$0.29 \pm 0.03^{\text{by}}$
	High	$0.09 \pm 0.03^{\text{abx}}$	$0.16 \pm 0.03^{\text{bx}}$	$0.16 \pm 0.03^{\text{bx}}$

^{a,b}Means with different letters in the same row are different ($P < 0.05$).

^{x,y}Means with different letters in the same column are different ($P < 0.05$). Mean \pm Standard Error.