Published April 25, 2019

2018 Reciprocal Meat Conference – Undergraduate Research Competition

Meat and Muscle Biology™

Supplementing Beef Steers with Ruminal Bypass Arginine Improves Oxidative Stability of Aged Beef Loins

J. Tuell[1],* H.-W. Kim[1], J. Guedes[1], J.-K. Seo[1], J. Schoonmaker[2], and Y. H. B. Kim[1]

[1]Meat Science and Muscle Biology Lab, Department of Animal Sciences, Purdue, University, West Lafayette, IN, 47907, USA; [2]Department of Animal Sciences, Purdue University, West Lafayette, IN, 47907, USA
*Corresponding author. Email: tuell@purdue.edu (J. Tuell)

Keywords: aging, arginine, beef quality, lysine, oxidative stability
Meat and Muscle Biology 2(2):182 **doi:10.221751/rmc2018.160**

Objectives

Supplementation of ruminal bypass amino acids, such as arginine (Arg) and lysine (Lys), in beef cattle rations has been suggested to improve growth performance, feed efficiency and carcass composition. However, its impacts on meat quality characteristics have not been fully investigated. Previous studies have indicated supplementation of Arg may have an antioxidative effect on skeletal muscle. Postmortem aging is widely practiced in the beef industry to improve eating quality characteristics, but extended aging period has been shown to adversely affect oxidative stability, resulting in rapid discoloration and/or off-flavor development. Hence, this study was conducted to evaluate the effects of ruminal bypass Arg and Lys supplementation on meat quality and oxidative stability of beef loins with 14 and 28 d aging times.

Materials and Methods

Forty cattle fed 4 different diets for 180 d (control-basal diet; additional supplementation of metabolizable treatments (10 g/d) of each Arg, Lys, and ArgLys, respectively) were harvested. At 1 d postmortem, paired loins (*M. Longissimus lumborum*) were separated from each carcass, vacuum-packaged, and assigned to 14 and 28 d aging at 2°C. After each assigned aging time, 3 beef steaks (2-cm thick) were made from each loin to measure meat quality attributes, such as pH, water-holding capacity (WHC) and Warner-Bratzler shear force. One steak was overwrap-packaged with polyvinylchloride film and displayed for 7 d at 2°C under fluorescent light (1450 lx) for instrumental and trained panel color evaluation. Oxidative stability was determined by measuring total reducing activity (TRA) and 2-thiobarbituric acid reactive substances (TBARS). The experimental design was a split-plot design with diet effect as whole plot and aging time as sub-plot. All data were analyzed using the PROC MIXED procedure of SAS version 9.4 (SAS Inst. Inc., Cary, NC), and means were separated by least significant differences ($P < 0.05$).

Results

No significant diet impacts on pH, WHC, and shear force were found ($P > 0.05$). An increase in aging duration decreased shear force ($P < 0.05$) and improved WHC of steaks as indicated by decreased cooking loss and display weight loss ($P < 0.05$). Extended aging for 28 d, however, negatively impacted color and oxidative stability of beef steaks over the display period, where steaks from 28 d had greater surface discoloration and TBARS values compared to steaks from 14 d ($P < 0.05$). However, Arg supplementation improved color stability of steaks during display regardless of aging period, shown by higher a* values, lower hue angle values and least sensory discoloration scores compared to other treatments ($P < 0.05$). Steaks from ArgLys had higher TRA and lower TBARS values compared to steaks from Arg and Lys ($P < 0.05$), but no differences between Arg and Lys were found ($P > 0.05$). This could indicate a synergistic ArgLys combination impact on oxidative stability of beef samples.

Conclusion

The results of this study suggest that Arg supplementation could be an effective strategy to improve color stability of beef loins with extended aging. Further studies to elucidate the mechanism through which Arg mitigates the negative effects of extended aging storage on color and oxidative stabilities are highly warranted. In particular, the influence of Arg supplementation on the synthesis of nitric oxide (NO) via the L-arginine-NO pathway in aged beef loins is under investigation.