Published February 1, 2019

2017 Reciprocal Meat Conference – Muscle and Lipid Biology and Biochemistry

Meat and Muscle Biology™

Mitochondrial Lipid Composition and Enzyme Activity of Post Mortem Beef Longissimus Muscle from Angus Steers Fed Endophyte-Infected Tall Fescue Seeds

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Keywords: tall fescue, beef, metmyoglobin reducing activity, mitochondria
Meat and Muscle Biology 1(3):151 **doi:10.221751/rmc2017.144**

Objectives

The objective of the study was to determine the effects of feeding endophyte-infected tall fescue seeds on mitochondrial fatty acid (FA) composition and phospholipid (PL) fractions and activity of superoxide dismutase (SOD) and metmyoglobin reductase (MRA) in beef *longissimus* muscle from Angus steers.

Materials and Methods

Twelve Angus steers were blocked by initial BW and randomly assigned to be fed with either KY32 (E- or control) or KY31 (E+ or treatment; approximately 20 µg of ergovaline per kg of BW) within a block. Steers were fed individually using Calan gates in the first 70-d trial in the summer of 2015, followed by a 149-d withdrawal period and the second 64-d trial in the winter of 2016. After the second trial, steers were implanted with a dose of Ralgro, finished for 66 d on summer perennial pastures, and slaughtered at approximately 500 kg of BW. Immediately after carcass decontamination, *longissimus thoracis* muscle was collected at the 12th rib on the left side of the carcasses, cubed, snap-frozen in liquid nitrogen, wrapped in aluminum foil, vacuum-packaged, and stored at -80°C for FA, PL, and SOD analyses. Strip loins were collected at 72 h post-mortem, aged for 14 d, trimmed to 0.3-cm backfat thickness, cut into 2.54-cm steaks, placed on black Styrofoam trays, overwrapped with PVC film (O_2 permeability of 1.21 mL/cm$^{2/}$d and water vapor permeability of 0.022 g/cm2/d; LINPAC Packaging-Filmco Inc., Aurora, OH), and placed under simulated retail display conditions (2 to 4°C, 900-lux fluorescent intensity, and 80% relative humidity) for 0, 1, 3, 5, and 7 d. One steak per animal per time point was collected for MRA analysis. Mitochondria were separated by ultracentrifugation and their lipids were extracted in 1:2 chloroform:methanol (v/v) and converted to fatty acid methyl esters to be analyzed by gas chromatography (Hewlett-Packard 6890 FID GC System; Agilent Technologies, Santa Clara, CA). Phospholipid classes were determined by thin-layer chromatography. Activity of SOD was determined by a colorimetric assay kit applicable for muscle (ab65354; Abcam, Cambridge, MA). Metmyoglobin reducing activity (µM of MMb reduced/min/g of muscle) was determined by reacting extracted muscle reductases with equine skeletal metmyoglobin and measuring deoxymyoglobin at 580 nm (Spectra max plus 384; Molecular Devices, Sunnyvale, CA). One steer with a large abscess, yielding pH of 6.35 and dark cuts, was excluded. Statistical analysis was performed by the GLIMMIX procedure of SAS 9.4 (SAS Inst. Inc., Cary, NC) at 0.05 level of significance.

Results

Feeding endophyte-infected tall fescue seeds did not affect mitochondrial FA composition, PL fractions, and SOD activity ($P \geq 0.14$). Metmyoglobin reducing activity of E+ steaks was 6.01 ± 0.37 µM/min/g, similar to that of E- steaks (6.92 ± 0.41 µM/min/g; $P = 0.117$). As expected, MRA was correlated with length of retail display ($r = –0.74$; $P < 0.001$) and decreased from 9.54 ± 0.49 µM/min/g on d 0 to 2.29 ± 0.93 µM/min/g on d 7 ($P < 0.001$).

Conclusion

Endophyte-infected tall fescue may not affect the integrity of mitochondria and MRA. A decrease in color stability was well correlated with decreased activity of metmyoglobin reductase.

