DEVELOPING AN IN SITU MODEL OF DFD BY INJECTING IODOACETIC ACID INTO PRE-RIGOR BOVINE MUSCLE

J. F. Buhler[1*], D. S. Dang[2], K. J. Thornton[3], D. P. Cornforth[2], and S. K. Matarneh[1],

[1]*Nutrition, Dietetics and Food Sciences, Utah State University, Logan, UT, USA*,

[2]*Nutrition, Dietetics and Food Sciences, Utah State University, Logan, UT, USA*,

[3]*Animal, Dairy and Veterinary Sciences, Utah State University, Logan, UT, USA*,

*jaredbuhlertorreon@gmail.com

I. OBJECTIVES

Of all factors impacting meat quality, the rate and extent of postmortem pH decline are often described as the most important. Dark, firm, and dry (DFD) is a meat defect mainly observed in beef cattle and results from abnormally high ultimate pH (pH > 6.0). This condition is usually attributed to depletion of muscle glycogen resulting from long-term antemortem stress. DFD meat is characterized as having an abnormally dark color, firm texture, and dry sticky feel, which makes it a major concern for the meat industry worldwide. However, DFD has a low incidence rate in the US, making it difficult for US-based researchers to obtain DFD meat samples. Therefore, the objective of this study was to develop an *in situ* model for DFD meat to facilitate research in this area. We hypothesized that injection of iodoacetic acid into pre-rigor muscle samples inhibits glycolysis and pH decline, resulting in meat with similar characteristics to those of DFD.

II. MATERIALS AND METHODS

The *longissimus thoracis et lumborum* muscle ($n = 8$) was excised within 0.5 h postmortem and fabricated into eight 2.5-cm steaks. Four steaks were injected with Na-iodoacetic acid at a 5 µmol/g of tissue, while the other 4 steaks were injected with water (control). One steak from each treatment was either immediately used (0 h storage) or vacuum packaged and stored at 4°C for 24 h, 168 h (7 d), and 336 h (14 d) postmortem. At the end of each storage period, a portion of each steak was snap-frozen in liquid nitrogen for pH and metabolite analysis, and the remainder of the steak was analyzed for color, drip loss percentage, cook loss percentage, and texture profile analysis. Data were analyzed as a 2 × 4 factorial arrangement using the mixed model of SAS-JMP (SAS Institute Inc., Cary, NC). Post hoc analysis was performed using a Tukey-Kramer multiple comparison, and differences were considered significant at $P \leq 0.05$.

III. RESULTS

At 24 h postmortem, treated steaks had greater pH ($P < 0.0001$) at 6.3 compared to 5.6 in control steaks. Treated steaks had lower lightness ($P < 0.0001$) values of 31.7 compared to 39.0 in control steaks. The pH and color values were similar to those of naturally occurring DFD meat. The elevated ultimate pH in the treated steaks was combined with lower glycogen degradation ($P = 0.005$) and lactate accumulation ($P < 0.0001$). These differences were maintained over the 336-h storage period. Further, drip loss percentage at 24 h was lower ($P < 0.0001$) at 1.5% in treated steaks and 4.5% in control steaks, and cook loss percentage at 168 and 336 h postmortem were 22.7% lower in the treated steaks ($P \leq 0.002$) compared to controls. Hardness values measured on raw steaks were greater ($P < 0.0001$) in the treated steaks at 80.1 N compared to 48.1 N in control streaks.

IV. CONCLUSION

Injecting pre-rigor muscle samples with Na-iodoacetic acid inhibits pH decline and results in meat that mimics characteristics of DFD meat. Because of these DFD-like characteristics, this model may allow for DFD-related research.

Keywords: color; dark, firm, and dry; iodoacetic acid; pH