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Meat and Muscle Biology™

The Relationship between Marbling, Superoxide Dismutase, and Beef Tenderness

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Objectives

It is known that excessive fat deposition (obesity) in humans induces metabolic stress, resulting in excessive production of reactive oxygen species (ROS). Perhaps ROS are responsible for tenderness differences between high and low marbled cattle. Our hypothesis is that marbling deposition is an indication of excessive energy intake, and excessive energy intake has been identified as a source of oxidative stress in livestock. Oxidative stress might enhance postmortem proteolysis and lead to more tender beef, resulting in the phenomenon we observe with Prime beef being more tender than Select beef. Superoxide dismutase (SOD) helps combat ROS by converting superoxide, the most potent ROS, into less toxic forms of oxygen, which are further broken down by other enzymes. Our objective was to identify the relationship between quality grade, tenderness, and SOD activity.

Materials and Methods

Beef strip loins (n = 36 Prime and n = 36 Select) were randomly selected and aged for 2, 7, 14, 21, and 28 d postmortem. Each strip loin was cut into one 1.27 cm lab sample and 5 individual 2.54 cm steaks, and each steak was randomly assigned to 1 of the 5 aging periods. Six cores were taken from each cooked steak and analyzed for tenderness using Warner-Bratzler shear force. The lab sample was aged for 2 d postmortem, powdered and stored at –80°C for SOD analysis.

Results

Prime steaks were significantly more tender (p < 0.0001) than Select steaks. Steaks from 14, 21, and 28 d of aging, were more tender than Day 7 (p = 0.02) steaks, and d 7 steaks were more tender than d 2 samples (p = 0.0001). There tended to be an interaction (p = .13) between age and quality grade with Select grade steaks exhibiting a greater decline in shear force. No significant interaction between quality grade and SOD activity was observed (p = 0.69).

Conclusion

These results suggest that the differences in quality grade and tenderness cannot be explained by the changes in SOD. Further exploration for other ROS species and enzyme inhibitors, such as catalase and glutathione, would be useful to examine if ROS are influential in tenderness.