Study demonstrates the muscle specific mitochondrial functionality and influence on fresh beef color stability

By Lindsay Pressman

The profitability of the beef industry is influenced by consumer's perception and purchasing of fresh beef based on its color. Beef color is determined by both the predominant form of myoglobin, a protein that carries and stores oxygen in muscle cells, on the steak surface and the activity of mitochondria in the meat. A recent study published in the Journal of Food Science by Mancini et al., entitled "Muscle-Specific Mitochondrial Functionality and Its Influence on Fresh Beef Color Stability" investigated oxygen consumption rate and mitochondrial metmyoglobin reducing activity of mitochondria isolated from beef *Longissimus lumborum* (LL), commonly known as loin eye, and *Psoas major* (PM), commonly known as tenderloin, steaks during retail display under aerobic conditions. When iron in myoglobin is oxidized to metmyoglobin, a brown discoloration of the steak surface occurs, causing retailers to reduce the price, resulting in $1 billion of lost revenue. Myoglobin and mitochondria compete for oxygen, which affects both initial color intensity and the formation of oxymyoglobin, responsible for the cherry red color that consumers prefer.

The researchers found that by isolating mitochondria from the loin eye and tenderloin steaks, they were able to assess the effects of muscle and display time on oxygen consumption rate and mitochondrial metmyoglobin reducing activity, and compare the color stability of each type of muscle. Steaks fabricated from loin eye and tenderloin were packaged in polyvinylchloride (plastic wrap) overwrap for 6 days at 4 degrees C, and mitochondria were isolated from the beef muscles after 0, 1, 3 and 5 days of display. The authors found that measurements of oxygen consumption rate and mitochondrial metmyoglobin reducing activity from isolated mitochondria supported the classification of beef PM as a color-labile muscle and LL as a color-stabile muscle based on color attributes. In both muscles, the OCR and MMRA decreased during display; however the OCR decreased more rapidly in PM steaks, and the MMRA decrease was less for mitochondria from LL steaks. The decrease in both OCR and MRA of the PM steaks contributed to its reduced ability to maintain color and the more stable OCR and MRA of the LL muscle contributed to increased color through maintenance of its different forms of iron in myoglobin.

The authors indicated that by developing strategies to minimize muscle-specific differences in mitochondrial changes, both color stability and the value of fresh beef could be increased. Dr. Mancini stated that “Although the tenderloin (filet mignon) is the most tender cut of beef, it exhibits the fastest surface

discoloration of the commonly marketed beef steaks. Research assessing the molecular basis of beef quality can decrease the amount of meat discarded due to discoloration and as a result, decrease food and packaging waste."

To view the full article, visit: Mancini, R.A., Belskie, K., Suman, S.P., and Ramanathan, R. (2018). Journal of Food Science. Vol.83(8), p.2077-20