INTRODUCTION

Meat purchasing decisions are influenced by color more than any other quality factor (Smith et al., 2000).

ECONOMIC IMPACT

- The NBQA in 2011 reported that 3.2% of carcasses assessed were dark cutting.
- According to the 2000 NBQA, dark cutting beef resulted in a $240 USD discount per carcass.
- Dark cutting beef costs the industry an estimated $5.81 USD per head.
- Canada has a yearly loss of $1.4 million in dark cutting beef (Wulf, 1998).
- Annual loss of $35 million to the Australian Beef Industry (Cooperative Research Centre CRC, 2012).

FACTORS RESPONSIBLE FOR DARK CUTTING BEEF

- Increased stress conditions
- Less glycogen in muscle
- Less lactic acid formation
- Elevated muscle pH

EFFECT OF ELEVATED PH ON MEAT QUALITY

1. Water holding capacity (WHC)
2. Increased mitochondrial activity
   - Light reflectance of meat
   - Oxygen consumption
1. EFFECT OF PH ON REFLECTANCE PROPERTY

Cross section of muscle bundles

Dark cutting beef, 10x
Normal pH beef, 10x

Increased pH leads to swelling of muscle fibers
Less water between muscle bundles
Less reflectance of light
Darker color

Cross section of muscle bundles

Dark cutting beef, 20x
Normal pH beef, 20x

2. EFFECT OF PH ON MITOCHONDRIA

Mitochondria out-compete myoglobin

Oxygen available to myoglobin

Competition for \( \text{O}_2 \)

- Oxygen consumption decreases initial red color development when mitochondria outcompetes myoglobin for oxygen
- Myoglobin then remains in a deoxy-state resulting in a dark colored muscle (Ledward, 1992)

EFFECTS OF ELEVATED PH ON MEAT QUALITY

Elevated Meat pH

1. Water holding capacity (WHC)
2. Increased mitochondrial activity

HYPOTHESIS

Altering the mitochondrial function and muscle structure will improve the oxygenation properties of dark cutting beef

OBJECTIVES

1. To determine the effects of extended aging on biochemical properties of dark cutting beef
2. To evaluate the effects of aging and freeze thawing on oxygenation properties of dark cutting beef
OBJECTIVE 1

EFFECTS OF EXTENDED AGING ON BIOCHEMICAL PROPERTIES OF DARK CUTTING BEEF

MATERIALS & METHODS

- Myoglobin was measured at absorbance 525 nm (AMSA, 2012)
- Mitochondria activity was measured using quantitative real-time PCR
- Oxygen consumption rate was measured. Greater oxygen consumption indicates greater mitochondrial activity

RESULTS

Myoglobin and mitochondrial content of dark cutting and normal pH beef

Mitochondrial content was 2.04 fold greater in dark cutting beef than normal pH.

- Different superscripts indicate significant differences (P<0.05).

% Oxygen consumption rate during extended aging of normal pH and dark cutting beef

Different superscripts indicate significant differences (P<0.05) across aging periods.

STATISTIC ANALYSIS

- Data were analyzed using the mixed procedure of SAS
- A split plot design with repeated measure
- Least squares means were separated using the PDIFF option (P<0.05) in SAS
CONCLUSION

- Extended aging can improve the color intensity (redness) of dark cutting steaks
- Extended aging can decrease oxygen consumption and limit mitochondrial activity

OBJECTIVE 2

EVALUATE THE EFFECTS OF FREEZE THAWING ON OXYGENATION PROPERTIES OF DARK CUTTING BEEF

FREEZE THAWING

- Research has shown that freeze thawing can decrease mitochondrial function
- Freeze thawing also increases the damage to the muscle structure
- Limited research has determined the effects of freeze thawing on myoglobin oxygenation of dark cutting beef

MATERIALS & METHODS

- PVC Packaging
  - Polyvinyl Chloride Overwrap
- Surface color was measured
  - Using a HunterLab miniscan spectrophotometer
- Bloom was measured at
  - 0, 15, 30, 60, 90 and 120 min

STATISTICAL ANALYSIS

- Data were analyzed using the mixed procedure of SAS
- A split plot design with repeated measure
- Least squares means were separated using the PDIFF option (P<0.05) in SAS
CONCLUSION

Freeze thawing

Disrupts mitochondrial membrane

Limiting mitochondrial activity

Increasing blooming properties of dark cutting beef

QUESTIONS

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