Introduction

- Beef tenderness is the most important attribute affecting consumer beef eating satisfaction
- Numerous studies have indicated steaks from cattle of greater Brahman genetics are tougher than steaks from Bos taurus cattle
- This is attributed to greater calpastatin activity (Wheeler et al., 1990; Shackelford et al., 1991; Pringle et al., 1997)
- Causes inhibition of calpain-mediated myofibrillar protein degradation
- Role of calpastatin enacts on steak tenderness of Brahman cattle may be overstated
- Riley et al. (2005) reported calpastatin activity was poorly correlated to Warner-Bratzler shear force (WBSF)
- Research has demonstrated steers of increased Brahman genetics have an increased expression of genes related to collagen crosslinking (Gonzalez et al., 2014)
- Indicating collagen solubility may be a contributor to tenderness of steaks from Brahman cattle

Objectives

- Examine the effect of Brahman genetics on myofibrillar protein degradation, collagen crosslinking, and meat tenderness of Longissimus lumborum (LL) steaks

Procedures

- Steaks from steers of greater Brahman genetics had decreased intensity of 38 kDa desmin, 34 kDa troponin-T, and 30 kDa troponin-T degradation bands (linear, \( P < 0.03 \))
- Increasing Brahman genetics increased \( ( P = 0.04 ) \) intensity of 36 kDa degraded troponin-T band
- There was no effect \( ( P = 0.14 ) \) of Brahman genetics on the amount of LL steak hydroxylysyl pyridinoline collagen crosslinks

Results

Cooked steak characteristics

Warner-Bratzler shear force analysis

- As the percentage of Brahman genetics increased, LL steak thaw loss and WBSF increased (linear, \( P < 0.01 \))
- There was no effect of Brahman genetics on cook loss \( ( P = 0.14 ) \)

Sensory analyses

- As the percentage of Brahman genetics increased, sensory panel scores of LL steak tenderness, connective tissue, and juiciness decreased (linear, \( P < 0.01 \))
- Indicating steak were tougher, had more connective tissue, and were less juicy
- Brahman genetics had no effect on beef flavor or off flavor scores \( ( P > 0.35 ) \)

Conclusions

- Longissimus lumborum steaks originating from steers of greater percentage of Brahman genetics had reduced tenderness when measured objectively and subjectively
- Trained sensory panelist detected an increase in connective tissue content as percentage of Brahman increased
- Decreases in tenderness steaks from steers with greater Brahman genetics were most likely due to the reduction in degradation of desmin and troponin-T proteins
- Not due to increases in hydroxylysyl pyridinoline crosslinks
- It is hypothesized Brahman genetics may increase other heat stable crosslinks, which may be responsible for the increase in connective tissue detected by panelists
**Procedures**

**Animals and steak fabrication**
- University of Florida Multi-breed Herd steers (n = 72) born in 2012 and 2013 were classified into 4 treatment categories based on percentage of Angus and Brahman genetics
- **100% Angus/0% Brahman**
- **62.5% Angus/32.5% Brahman**
- **50% Angus/50% Brahman**
- **0% Angus/100% Brahman**

- Steers were harvested at common compositional endpoint of 1.0-1.5 cm backfat
- A 7.62-cm thick LL roast extending from the 13th rib towards posterior end of loin was collected from each carcass and aged 14 d

- After aging, 3, 2.54-cm thick steaks were fabricated from each roast
- **Steak 1** → Utilized for Warner-Bratzler shear force (WBSF)
- **Steak 2** → Utilized for trained sensory evaluation
- **Steak 3** → Utilized for myofibrillar protein degradation and collagen crosslink analyses

**Warner-Bratzler shear force analysis**
- Steaks cooked on open-hearth Farberware grills (Model 450-A; Yonkers, NY)
- Steaks cooked to internal temperature of 71°C
- Cut into 1.27 × 1.27 × 2.54 cm cubes
- Two cubes of each sample presented to 8-member trained panel

- Evaluated 6 samples per session for:
  - Tenderness, connective tissue, juiciness, beef flavor intensity, and off-flavor intensity using 8-poin scales
  - 1= extremely tough, abundant, extremely dry, extremely bland, and extreme off-flavor
  - 8= extremely tender, none, extremely juicy, extremely intense, no off-flavor

**Desmin and Troponin-T analysis**
- Desmin and troponin-T degradation quantified using western blot procedures adapted from Melody et al. (2004)

**Sensory analysis**
- Steaks cooked on open-hearth Farberware grills (Model 450-A; Yonkers, NY)
- Steaks cooked to internal temperature of 71°C
- Cut into 1.27 × 1.27 × 2.54 cm cubes
- Two cubes of each sample presented to 8-member trained panel

**Collage crosslink analysis**
- **100 mg of dried sample was hydrolyzed in 2 mL 6 M HCl at 105°C**
- Samples were diluted to 10 mL and pH raised to 7.0
- Sample concentrations of the collagen crosslink hydroxylysyl pyridinoline were analyzed using a commercial ELISA kit (8004; Quidel Corporation, San Diego, CA)

**Statistical analysis**
- Data were analyzed as a generalized randomized complete block design using the MIXED procedure of SAS (SAS Institute Inc., Cary NC)
- Fixed effect: Treatment
- Random effect: Year
- Linear and quadratic contrasts for Brahman percentage were tested
- Differences were considered significant at P ≤ 0.05 and tendencies at P > 0.05 and P ≤ 0.10

**References**


Cooked steak characteristic results

Effect of Brahman genetics on myofibrillar protein degradation, collagen crosslinking, and meat tenderness

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Linear effect of Brahman $P < 0.01$
Quadratic effect of Brahman $P = 0.44$

Linear effect of Brahman $P = 0.01$
Quadratic effect of Brahman $P = 0.86$

Linear effect of Brahman $P = 0.01$
Quadratic effect of Brahman $P = 0.81$

Linear effect of Brahman $P < 0.01$
Quadratic effect of Brahman $P = 0.49$

Linear effect of Brahman $P < 0.01$
Quadratic effect of Brahman $P = 0.22$
Effect of Brahman genetics on myofibrillar protein degradation, collagen crosslinking, and meat tenderness

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Myofibrillar protein degradation and collagen crosslinking results

![Graphs showing Desmin 38 kDa band, Troponin-T 36 kDa band, Troponin-T 34 kDa band, and Hydroxylysyl pyridinoline as a function of Brahman percentage.]

- Linear effect of Brahman: Desmin $P < 0.01$, Troponin-T 36 kDa band $P = 0.04$, Troponin-T 34 kDa band $P = 0.03$, Hydroxylysyl pyridinoline $P = 0.14$.
- Quadratic effect of Brahman: Desmin $P = 0.89$, Troponin-T 36 kDa band $P = 0.47$, Troponin-T 34 kDa band $P = 0.13$, Hydroxylysyl pyridinoline $P = 0.14$.

Linear effect of Brahman $P < 0.01$
Quadratic effect of Brahman $P = 0.89$

Linear effect of Brahman $P = 0.04$
Quadratic effect of Brahman $P = 0.47$

Linear effect of Brahman $P = 0.03$
Quadratic effect of Brahman $P = 0.13$

Linear effect of Brahman $P = 0.14$
Quadratic effect of Brahman $P = 0.14$