TEMPERAMENT ASSESSMENT PROVIDES INSIGHT INTO FUTURE HEALTH AND GROWTH PERFORMANCE OF BEEF CATTLE

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Introduction

- Our research team has focused on elucidating the interactions between disposition and physiological stress on production performance in beef cattle.
- One aspect of this research, involves the evaluation of the combined effects of transportation stress and animal temperament on real-time ultrasound body composition traits (primarily ultrasound intramuscular fat).

Introduction

- Stressful events induce secretion of several of the prominent stress-related hormones:
  - Cortisol
  - Epinephrine
  - Norepinephrine
- Chronic Stress has been reported to negatively impact growth, reproductive function, and immune function (Moberg, 1987; Dobson et al., 2001).
- Minimizing adverse consequences of multiple stressful incidents and identification of animals that may react poorly to multiple stressful events may be beneficial to health and growth of cattle.

Materials and Methods

- Assessments of cattle temperament can be evaluated utilizing subjective measures [chute scores (Grandin, 1993) and pen scores (Kunkel et al., 1986)] and an objective measure utilizing chute exit velocity (Burrow et al., 1988).
- Chute scoring (CS) (adapted from Grandin 1993) where visual appraisals of each animal, while confined but not restrained in a working chute on a 1 to 5 scale.
- Pen scores (PS; Kunkel et al., 1986) were based on visual assessments of each animal while being confined to a pen with groups of three animals.

Materials and Methods

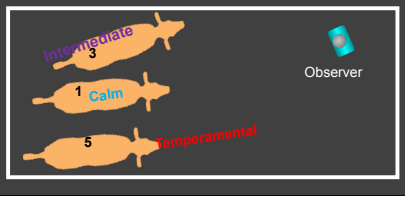
- Chute Scoring
- Measurement taken while animal is confined but not restrained within a weigh box
  - 1 – calm – no movement
  - 2 – restless, shifting
  - 3 – squirming, occasional shaking of the squeeze chute or scale
  - 4 – continuous vigorous movement and shaking of the device
  - 5 – 4 plus rearing, twisting or violently struggling

Grandin, 1993

Measurements of Temperament

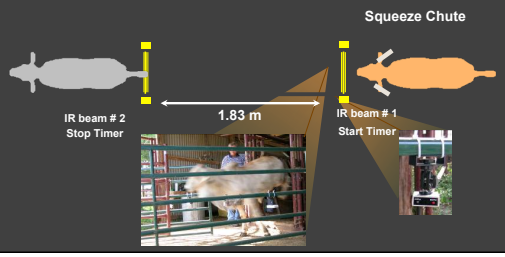
- **Pen score**
  - ***Subjective* temperament measurement** *(Hammond et al., 1996)*
  - **Cattle are separated into groups of 3-5 and fear response to a human observer ranked on a scale of 1 (*calm*) to 5 (very *temperamental*)**

Score + EV =



Measurements of Temperament

- **Exit velocity**
  - ***Objective* temperament measurement** *(Burrow, 1997; Curley et al., 2006)*
  - **Time (s) for calves to traverse a distance of 1.83 m**



Discussion

- Calves exhibiting greater exit velocity or leave the working chute at a greater speed are usually more temperamental than calves that leave the working chute at a lesser speed.
- Secretion of stress related hormones is exaggerated in more temperamental calves (Curley et al., 2006a, 2006b, 2008).
- Exit Velocity measurements can occur at all ages, however, most practical for producers to assess at weaning time and provide a ranking of which animals are the "flightiest" and therefore provide information on possible culls due to disposition.

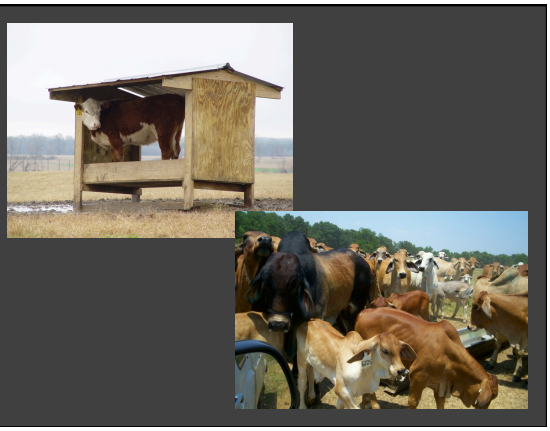
Discussion

- Animal temperament has been shown to have negative impacts on both beef and dairy production.
- Cattle with more "excitable" temperaments:
  - Exhibit lower body weights (Burrow, 1997; Voisinet et al., 1997).
  - Produce tougher meat, lighter carcass weights (King et al., 2006; Voisinet et al., 1997).
  - Inhibited milk production (Drugociu et al., 1977; Breuer et al., 2000).
  - Increased amounts of bruise trim due to injuries acquired during transportation or handling (Fordyce et al., 1988).
  - Reduced ADG in feedlots combined with increased treatment costs (Vann et al., 2008, Busby, 2005).

Temperament Research Results

- Established repeatability of temperament scoring and established a baseline age for temperament evaluation.
- Evaluated response to vaccination based on temperament scores.
- Evaluated gain, production parameters and product quality post-weaning and at the feedlot.
- Evaluated response to an endotoxin challenge.

- Relationships between temperament and transportation utilizing continual rectal temperature recording devices (Burdick et al., 2010).
  - Rectal temperature peaked within 30 min after the onset of transportation with temperamental bulls having greater peak rectal temperatures than calm or intermediate bulls ($P < 0.05$).
  - Prior to transportation, temperamental bulls had greater cortisol concentrations than calm bulls ($P < 0.05$).
  - Temperamental bulls also had greater concentrations of cortisol and epinephrine post-transportation than calm bulls ($P < 0.05$).
- Subsequent studies suggests that the most stressful part of transportation actually occurred prior to the transport event, and was more closely associated with the sorting and loading process (Burdick et al., 2011).
- These studies suggest that temperamental cattle react very differently to varying aspects of management practices and that human-animal interactions are probably the most stressful events these animals encounter.



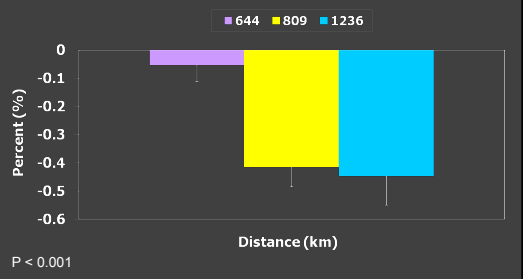
Research Results

Evaluation of ultrasound body composition traits as affected by temperament and transportation stress

Materials and Methods

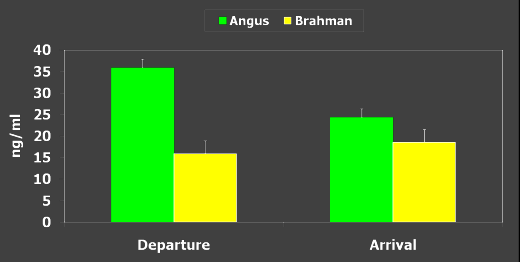
- Three sets of steers were hauled three distances (644, 809 and 1236 km) to a feedlot.
- Body weights were collected at the same times as the mean exit velocity.
- Real-time ultrasound measurements for longissimus muscle area, rib fat, rump fat and gluteus medius depth were taken on steers prior to departure to the feedlot and again upon arrival at the feedlot.

Percentage Change in Intramuscular Fat

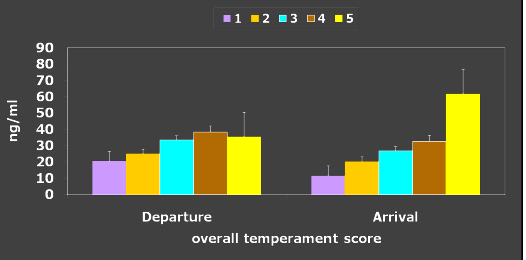


P < 0.001

Cortisol Concentrations



Cortisol Concentrations as reflected by temperament



P < 0.02

Summary and Conclusion

- Angus crossbred steers hauled shorter distances had smaller changes in %IMF than Brahman steers (P < 0.002).
- As the distance cattle were hauled increased, % IMF values decreased.
- These results suggest that hauling stress has negative effects on body composition traits specifically percent intramuscular fat and rib fat.
- However, due to overall animal stress, overall temperament score did not impact body composition traits.

Effect of long-term transportation and lipopolysaccharide challenge on immune response, endocrine function and feeding behavior in crossbred beef heifers

- Transportation of beef calves is a stressful event that can negatively impact growth and immune function by making these calves more susceptible to disease upon arrival and co-mingling with other calves.
- Effect of transportation or LPS challenge on feeding behavior utilizing the GrowSafe® feeding system.
- Three treatment groups:
  - Transport (12 h transport each way)
  - Feed
  - No Feed

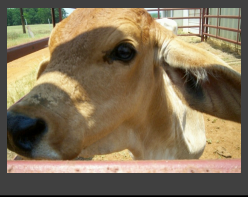
ASAS 2011 Abstract #540; Loyd et al. 2011

- Feed intake was influenced more by transportation and withdrawal than the LPS challenge.
- Results indicate that the shrink observed in transported calves is likely the result of feed and water withdrawal.
- Stress associated with transport may hinder feed intake immediately following transport, No feed heifers had greater feed intake ($P < 0.01$) than transported heifer which were greater than feed heifers (8.5, 5.9, and 2.4 kg, respectively).

ASAS 2011 Abstract #540; Loyd et al., 2011

Additional Current Research

- Determining effects of stressors, temperament, and lipolytic hormones on adipocyte metabolism and meat quality in beef cattle.
- Glucose Tolerance Test of cattle of variant temperaments
- Grow Safe- Feed Efficiency and Feed Behavior



Glucose Challenge

- Objective – Determine the effects of temperament on glucose and insulin following a cannulation stressor and during a subsequent glucose challenge.
  - Calm (n=6) and Temperamental (n=6) heifers
  - Cattle were monitored for 4 h after the glucose challenge
  - Temperamental heifers had elevated glucose and insulin concentrations during this challenge period.
- Results indicate that temperament has an impact on cortisol secretion following this stress which subsequently results in elevated glucose and insulin concentrations.

Bradbury et al., 2011; SAAS Abstracts

GrowSafe® Feeding Behavior

- Evaluation of feeding behavior and intake in freshly weaned heifers.
  - Effects of temperament and relationship to adjustment to eating out of the bunks.
  - Large amounts of variation in adjustment time between introduction to the bunks and feed consumption.

ASAS 2011 Abstract #328; Loyd et al., 2011

Relationship between temperament, blood flow and area in the external jugular vein and body temperature in crossbreed beef calves

- ASAS Abstract #M16; Sanchez et al., 2011
- Utilizing Doppler ultrasound to examine the relationship between temperament, blood flow, vascular dimensions and body temperature.

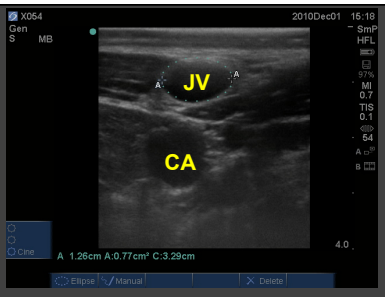


Figure 1. Cross sectional B Mode ultrasonographic image of the bovine carotid artery (CA) and jugular vein (JV) in the central part of the right side of the neck. Note the spherical caliper around the jugular vein. Values at the bottom are diameter (cm), area (cm^2), and circumference (cm).

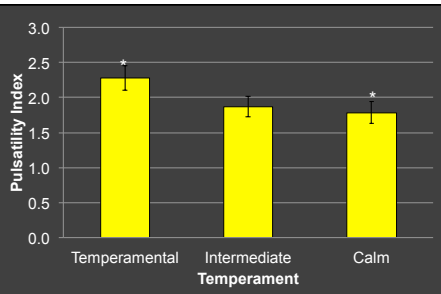


Figure 3. Relationship between temperament and Pulsatility Index in the right jugular vein of Angus cross calves. *Trend (P = 0.0948) to differences between temperamental and calm calves.

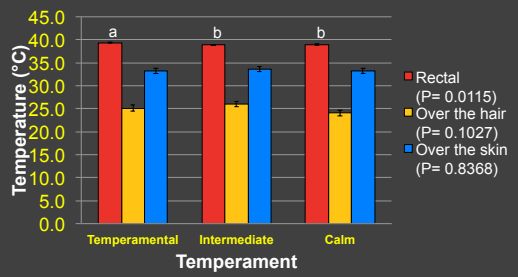


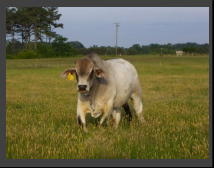
Figure 5. Relationship between temperament and body temperature (rectal, neck over the hair, and neck over the skin) in Angus cross calves. Different letters indicate significant differences with in anatomical part (α = 0.05).

CONCLUSION

- Relationship between temperament and some important indicators of the animal's physiological status
  - Internal body temperature
  - Pulsatility Index
- Physiological changes can influence
  - Performance of beef cattle
  - These markers may be beneficial in developing better tools for selection of beef cattle

Summary

- Animal temperament can be measured in several ways however, our data indicate that the subjective pen score method and the objective exit velocity measurements appear to have higher heritability values compared to just one method alone (Loyd et al., 2011; ASAS Abstact #537).



- Temperamental animals seem to react very differently to varying aspects of management practices and that human-animal interactions are probably the most stressful events these animals encounter.
- Temperamental animals appear to have greater reductions in percent intramuscular fat with increasing distances these animals are transported.
- Temperamental animals respond very differently to glucose challenges and LPS challenges compared to calmer cattle.
- Temperamental animals tend to have elevated body temperatures and pulsatility index.

- Future Research
  - Continue to explore more interactions of cattle temperament and immunity, and lifetime production efficiency in beef cattle.
  - Interactions of feeding behavior, cattle temperament and weaning stress.
  - Mechanisms of utilization of glucose, insulin and other metabolites as sources of energy for these animals of varying temperaments.

Questions