

Project Summary

Evaluation of Temperament Indicator Traits to Predict Growth Performance and Beef Tenderness Traits in Finishing Steers

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**Study Completed
May 2007**



Funded by The Beef Checkoff

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Background

Temperament has been identified as an animal's behavioral responses to handling by humans. Previous research suggests that exit velocity from a chute may be an objective measurement of temperament and stress responsiveness in cattle. Cattle with more excitable temperaments and faster exit velocity have been reported to produce less tender beef than cattle with more calm temperaments and slower exit velocity. However, there are a number of factors that can influence exit velocity measurements and reduce the accuracy of exit velocity as an indicator trait for growth performance and beef tenderness. Previous results demonstrate that feeding behavior traits have considerable potential to be linked to key traits. The overall objective for this research was to evaluate the utility of temperament indicator traits to sort feeder calves into outcome groups with predictable growth performance and beef tenderness phenotypes.

Methodology

Adaptation Phase

Santa Gertrudis steers (n=120) were preconditioned at the King Ranch, transported and allowed to rest overnight. At processing, steers were weighed, blocked by weight and randomly assigned within weight to receive 1.5 mL/100 lb body weight of ceftiofur crystalline free acid (Excede[®]) administered at the base of the ear, or to receive no antimicrobial (control). Steers were weighed on days 0, 14 and 28 and temperament was assessed on days 0 and 28 using subjective chute scores and exit velocity measurements. Feed intake and feeding behavior traits were recorded continuously from day 7 to 28 using a GrowSafe[®] feeding system.

Growing and Finishing Phases

Following the adaptation period, feed intake, feeding behavior traits and body weight were measured for 70 days using the GrowSafe[®] system. Immediately following, steers were adapted to a high-grain diet for 28 days. Thereafter, feed intake, feeding behavior traits and body weight were measured. Ultrasound measure of 12th rib fat thickness, *Longissimus dorsi* (LD) muscle area and intramuscular fat were obtained on days 0, 35 and 70 of both the growing and finishing phases. Subjective temperament scores and exit velocity were measured on days 0 and 70 of the growing and finishing phases.

Carcass Characteristics and Beef Tenderness

Steers were harvest and carcasses were electrically stimulated and then chilled for 48 hours. A 20 g sample was removed from the *M. longissimus dorsi lumborum* between the 3rd and 4th lumbar vertebrae 30-45 minutes post-exsanguination to determine μ -calpain at 45 minutes. At 24 hours post-mortem, a 50 g sample was removed from the *M. longissimus dorsi lumborum* between the 5th and 6th lumbar vertebrae to determine 24-hour μ -calpain and calpastatin levels. Sarcomere length was determined to verify that myofibrillar contractile state did not influence tenderness. After 48 hours of chilling, carcasses were split and USDA quality and yield grade factors were evaluated. Lean color and pH were also evaluated. The *M. longissimus dorsi lumborum* was removed and the first anterior steak was cut and used for internal chemical lipid determination. Two additional steaks were removed from the anterior end and randomly assigned to 1 or 14 day aging for Warner-Bratzler shear force determination.

Findings

Adaptation Phase

Metaphylactic therapy had a positive effect on performance during the 28-day adaptation phase of this study. Steers administered Excede had higher average daily gain from day 0 to 14 and tended to have higher average daily gain during the 28-day study when compared to control steers. Meal frequency was higher and bunk-visit frequency tended to be higher in steers treated with Excede[®] compared to controls. Interactions demonstrated that calm steers responded to metaphylactic therapy differently than excitable steers. In steers with moderate excitable temperaments, steers treated with Excede[®] had higher average daily gain than control steers. Metaphylactic therapy resulted in higher dry matter intakes for steers with excitable temperaments.

Within the steers classified as having excitable temperaments, those treated with Excede[®] spent more time per day at the feed bunk consuming feed compared to control steers. Steers treated with Excede[®] consumed more meals per day than control steers, but this beneficial response to Excede[®] was similar for all treatment groups. In general, exit velocity was more effective than subjective chute scores to assess the effects of temperament classification on performance responses to metaphylactic treatment with Excede[®]. Results demonstrate that metaphylaxis resulted in positive effects on average daily gain, dry matter intake and feeding behavior during the receiving period for steers with excitable temperaments, whereas, metaphylaxis had less utility for steers with calm temperaments.

Growing & Finishing Phase

Both the subjective and objective temperament traits were negatively correlated with average daily gain during the growing phase, such that calves with excitable temperaments gained slower than the calves with calm temperaments. However, the temperament traits were not significantly correlated with feed intake or either of the feed efficiency traits. Exit velocities at the start of the growth phase were negatively correlated with backfat thickness, yield grade and hot carcass weights, such that calves with excitable temperaments were leaner and had lighter carcass weights than calves with calm temperaments. However, the temperament traits were not correlated with ribeye area or marbling scores, with the exception that exit velocity measured at the end of the growing phase was negatively correlated with both marbling and quality grade. In general, calves classified as having excitable temperaments had lighter initial and final body weight and average daily gain during the growing phase, but similar intakes, efficiencies and feeding behavior traits compared to calves classified as having calm temperaments.

Carcass Characteristics and Tenderness

Carcass characteristics indicated that carcasses, on average, had 1.10 cm of subcutaneous fat thickness, had slightly lower than average ribeye area and hot carcass weights and were Select quality grade. Steaks were tender at 1 and 14 days of aging and improved in tenderness from 1 to 14 days.

Live animal performance traits of initial and final live weight, average daily gain and dry matter intake during growing and finishing were slightly related to marbling, quality grade and hot carcass weights. Heavier steers that had higher average daily gain and dry matter intake during both phases had higher marbling scores and heavier hot carcass weights.

Exit velocities at the start of the growth phase were negatively correlated with subcutaneous fat thickness, yield grade and hot carcass weights, such that calves with excitable temperaments were

leaner and had lighter carcass weights than calves with calm temperament. Ultrasound data tended to be moderately correlated to comparable carcass characteristics.

Calves classified as having excitable temperaments, had lighter carcass weights, less carcass fat and lower yield grades, but similar ribeye area, marbling scores and quality grades compared to calves with calm temperaments. Compared to calm calves, sarcomere lengths were longer in moderate and excitable calves; however, Warner-Bratzler shear force values did not differ between temperament classification groups after 1 or 14 days of aging.

Regressing equations to predict tenderness using live animal growth, ultrasound, temperament indicator traits and eating behavior traits were not highly predictive. Up to 74% of the variation in yield grade could be predicted using 12 live animal traits, but when ultrasound traits were not included in the prediction equation, only 39% of the variability could be predicted. These results further confirm that ultrasound traits are related to final carcass characteristics of marbling and yield grade.

Implications

Live animal temperament indicator traits were related to live animal growth and performance traits which subsequently impacted carcass characteristics. Exit velocity appeared to be the best single indicator of live animal temperament and segmentation of steers at the beginning of the growing phase into temperament groups based on exit velocity could provide a valuable tool for segmentation of steers into outcome groups for expected live animal performance and carcass traits.

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