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Relationships of Beef Cattle Temperament with Feedlot Performance

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RELATIONSHIPS OF BEEF CATTLE TEMPERAMENT WITH FEEDLOT PERFORMANCE

by

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Abstract

This study determined relationships between beef cattle temperament and their feedlot performance. Thirty-five Angus cross-bred steers and heifers (18 steers and 17 heifers) were placed in the Utah State University feedlot to take part in the feed trial. Cattle temperament was measured by a chute score (CS, ranging from 1 = calm and not moving to 5 = rearing and violently struggling) and flight speed. Flight speed was measured by two observers to determine how long the animal took to travel 12 feet from the exit of the squeeze chute. Feedlot performance was assessed by body weight (BW) measurements, average daily gain (ADG) and feed efficiency. Individual daily feed intake was measured as well. Temperament scores were taken at the animal's introduction to the feedlot and at 28 day intervals throughout the trial. A total of 7 different BW measurements and temperament scores were included in this trial. As time progressed, all temperament measurements decreased. Across all three measurements day 0 was significantly higher than day 168 ($P < 0.0001$). Within heifers there was a negative correlation between daily feed intake and three time points. Weight was different between sex class with steers weighing an average of 108.5 lbs more than heifers ($P=0.0027$) on day 168. Daily feed intake ($P=0.089$) and average daily gain ($P=0.007$) differed between the sexes, but feed efficiency did not ($P=0.983$). Results of this study indicate that there is not a significant difference in temperament, but there was a difference between sexes in weight. Correlation results indicate that heifer temperament may have greater implications for daily feed intake in comparison with steers.

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Introduction

The temperament of livestock has been shown to affect growth and carcass traits. Cattle with unfavorable temperaments (restlessness, excitability, aggressiveness) tend to show less weight gain (Burrow, 199; Behrends, 2009; Café et al, 2014), produce tougher meat (Burrow, 1997; Behrends, 2009) and decreased marbling (Busby, 2006).

The sex of the animal has also been shown to have an effect on the animal's temperament and feedlot performance measurements. Café et al. (2014) found heifers to always have higher temperament scores, even though they generally were not significantly different.

It has also been shown that as animals become accustomed to handling their temperament scores decrease. Behrends et al. (2009) reported that exit velocity tended to be faster at weaning and entrance into the feedlot than at later dates. King et al. (2006) found that repeated measurements led to decreased exit velocities. Therefore, initial temperament may have long term implications for feedlot performance and carcass traits. The objective of this study was to add to the present understanding of cattle temperament and performance.

Materials and Methods

Pasture and Backgrounding

Approximately equal numbers of steers (n=15) and heifers (n=19) were acquired from the Utah State University Beef Research Herd. All calves were from heavily influenced Angus cows in the Utah State University cattle herd that were naturally bred from the same purebred Angus bull. Calves were with their mothers in university pastures until weaning at an average of 206 days of age. The range of ages at weaning was 156 to 227 days of age.

Weaned calves were trucked to the Utah State University Feedlot. Each calf was given a Ralgro Implant (Merck Animal Health, Summit, NJ) to simulate a common feedlot procedure. A transition diet was fed for about 7 weeks. The diet consisted of approximately 20% concentrate from barley, 33% alfalfa hay, and 47% corn silage. The Ralgro Implant was administered again on day 84 of the feedlot portion.

Feedlot Management

At the end of the seven weeks calves were weighed; then randomly assigned individual pens and switched to a grower diet for 84 days. Following the 84 day feed period, the ration concentrates were stepped up an average of 12% at approximately 17 day intervals. A summary of rations can be found in Table 1. In addition, 3% of the diet consisted of a feedlot vitamin and mineral mix from Walden Feed West (Cache Junction, UT) containing Rumensin (Elanco Animal Health, Greenfield, IN). The mineral content of this mix can be found in Table 2.

Table 1. Ration breakdown

	Barley Concentrate	Alfalfa Hay	Corn Silage	Supplement
Background	20.0%	33.0%	47.0%	3%
Grower Ration	27.0%	27.0%	43.0%	3%
Day 111	39.0%	26.0%	31.0%	3%
Day 124	52.7%	25.1%	19.2%	3%
Day 138	65.1%	22.8%	9.1%	3%
Day 153	76.8%	17.3%	2.8%	3%

Table 2. Mineral Mix Summary

Crude protein	11.00%
Salt	5.50%
Phosphorus	0.50%
Calcium	8.50%
Magnesium	0.24%
Potassium	0.76%
Sulfur	0.46%
Sodium	2.00%
Rumensin	360 PPM

During the feed trial, feed was given by a Rissler 610 TMR feed cart (E Rissler MFG LLC., New Enterprise PA). Daily feed was given in excess to allow calves to eat until satisfied. Amount of feed remaining was subtracted from feed given to determine the actual pounds eaten.

Temperament

Temperament scores were evaluated at weaning as well as days 0, 28, 56, 84, 112, 140 and 168 of the feed trial. Two measurements were used to determine temperament: Escape Velocity (EV; m/s) and Chute Score (CS). EV was measured in a similar manner as King et al. (2006) describes, however, rather than the use of infrared sensors, 2 manually operated stopwatches were used to record the time taken to travel between two lines at 1 meter and 4.6 meters in front of the squeeze chute. The CS measurement was similar to the method used by Grandin (1993). Upon entering the squeeze chute and before any human contact, calf behavior was evaluated and assigned a score of 1-5. Grades are based on the following descriptions: 1: calm, no movement; 2: restless shifting; 3: squirming, occasional shaking of the chute; 4: continuous vigorous movement and shaking of the chute; 5: rearing, twisting, or violently struggling (Voisinet et al, 1997). The overall temperament score was calculated as the average of the animals EV and CS.

Performance Measurements

There were three different performance measurements calculated as a part of this study: daily feed intake, average daily gain and feed efficiency. Feed intake (lbs) was measured as the daily difference between feed given and feed remaining. Average daily gain was calculated as the weight gained between weighing's divided by number of days between each weighing (28 days). The last performance measurement, feed efficiency, was determined as the feed eaten (lbs) divided by the weight gained (lbs).

Statistical Analysis

Cattle sex class and day were considered fixed effect while pen number was included as a random variable in the model. Day was considered a repeated measure, the best covariance structure was determined based on the Akaike Information Criterion (AIC) that selects a model from a set of models. Autoregressive (AR [1]) covariance structure was used for the repeated measures analysis based on the lowest AIC.

All statistical analyses were performed by SAS® version 9.3 (SAS Institute, Cary, NC) using the GLIMMIX procedure. Denominator degree of freedom was calculated by using the Kenward–Rogers approximation. Means were separated by protected t-test using the LSMEANS/PDIFF option. An effect was considered significant at $P \leq 0.05$.

The CORR procedure of SAS was used to determine Pearson's correlation coefficients between initial chute score, exit velocity, and temperament score with performance measures. Correlations at $P \leq 0.05$ were considered to be significant, while correlations at $P \leq 0.1$ were considered to be a tendency.

Results and Discussion

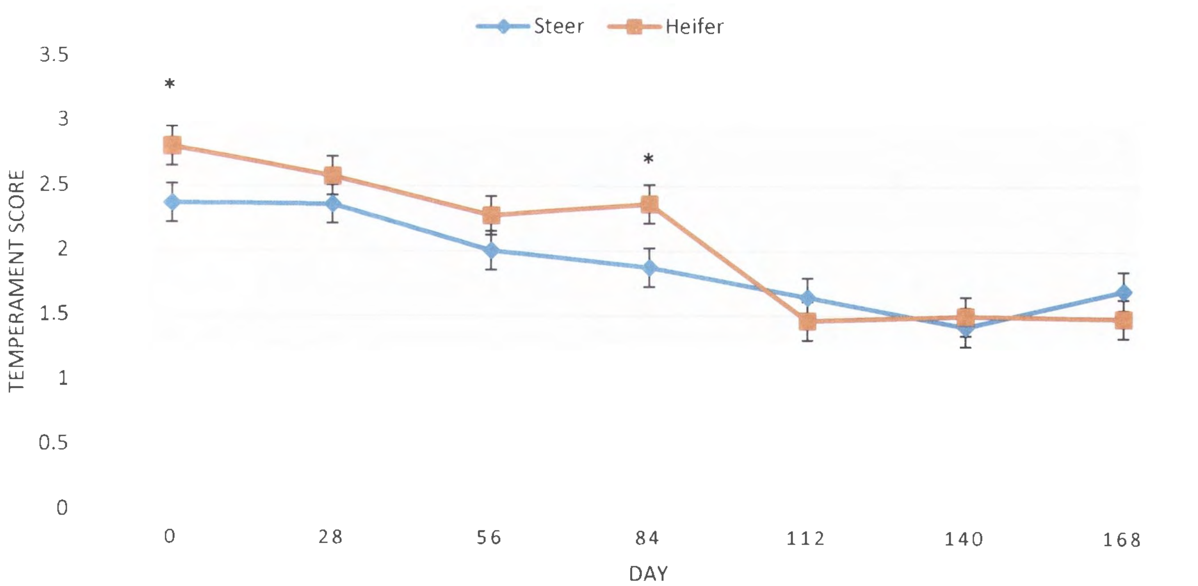
Temperament Score Interaction between Steers and Heifers over 168 days

Calf temperament measurements are presented in Figures 1 and 2. As time progressed, temperament score decreased; both sexes' day 0 chute score was significantly higher than day

168 chute score (P < 0.0001). This trend continues with both exit velocity (P < 0.0001) and temperament score (P < 0.0001). Previous research and practical experience supports this finding. King et al. (2006) reports that exit velocities were slower at mid feedlot than at weaning and entrance to the feedlot. Furthermore, Hearnshaw et al. (1984) found that cows have lower temperament scores than calves, indicating that they became accustomed to handling throughout their lifetime.

There were also sex differences between exit velocity and temperament score. Figure 1 illustrates that heifers generally had a greater temperament score, however the only days that males and females were significantly different were day 0 (P=0.0286) and day 84 (P=0.0126). This corresponds with results found by Café et al. (2014), who found that heifers had numerically greater temperament scores but the differences usually insignificant.

Figure 1- Temperament Score by Day and Sex

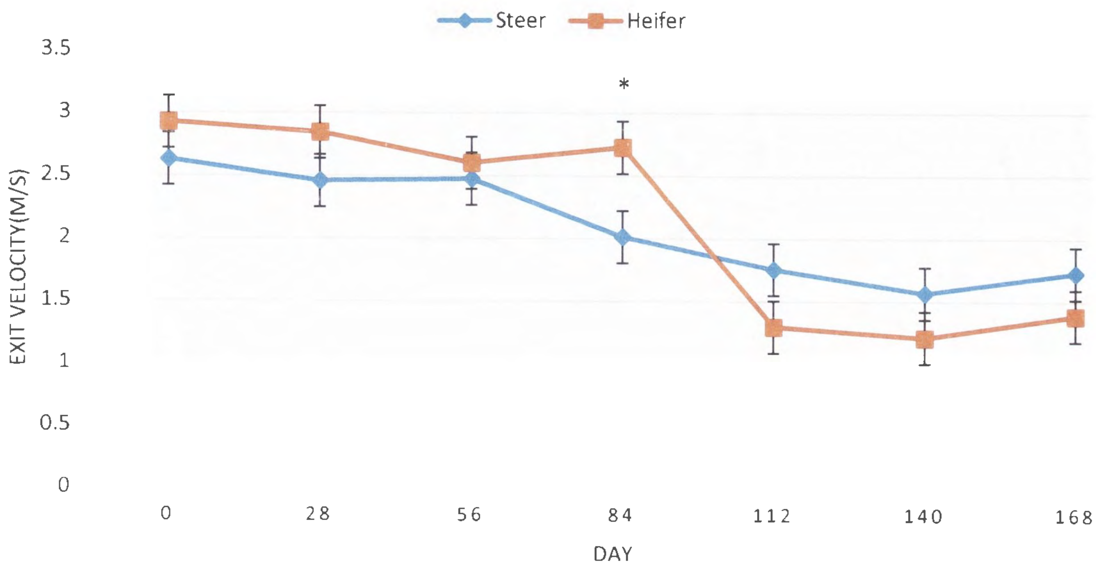


* Within day steers and heifer differ (P<0.05). Means within days lacking astericks do not differ between steers and heifers (P>0.05).

Similar results were found with exit velocity. Day 84 (P=0.0092) resulted in heifers having faster exit velocities than steers. However, day 112 resulted in heifers having a tendency

(P=0.0915) for a slower exit velocity. No research could be found to explain this. Slightly different handling during that time period or other biological and environmental factors may have influenced the observed change in exit velocities.

Figure 2- Exit Velocity by Day and Sex



* Within day steers and heifer differ (P<0.05). Means within days lacking asterisks do not differ between steers and heifers (P>0.05).

Correlations to Initial Scoring

Feedlot performance measurements were correlated with weaning temperament measurements to determine if they had an effect on the feedlot performance. Little to no correlations were found for the group overall, as well as steers and heifers separately.

When looking at the whole group (Table 3) weaning chute score and temperament score was negatively correlated with feed efficiency for the first 28 days ($P \leq 0.05$). Daily feed intake on day 56 ($P \leq 0.05$) was negatively correlated with weaning exit velocity. Weaning exit velocity also had a tendency ($P \leq 0.1$) to negatively affect average daily gain and positively affect feed efficiency on day 56. Day 112 weight was positively affected ($P \leq 0.1$) by weaning exit velocity.

Table 3- Correlations between overall feedlot measurements and weaning temperament measurements

Overall Feedlot Measurements	Weaning Chute Score	Weaning Exit Velocity	Weaning Temperament Score
Weaning Weight	0.04	-0.27	-0.13
D 0 Weight	0.01	-0.29*	-0.17
D 0 Chute Score	0.01	-0.13	-0.07
D 0 Exit Velocity	0.06	0.50**	0.35**
D 0 Temperament Score	0.04	0.23	0.17
D 28 Weight	0.07	-0.27	-0.11
D 28 Daily Feed Intake	0.15	-0.28	-0.06
D 28 Average Daily Gain	0.27	-0.07	0.16
D 28 Feed Efficiency	-0.35**	-0.17	-0.37**
D 28 Chute Score	-0.15	0.11	-0.04
D 28 Exit Velocity	0.34**	0.17	0.36**
D 28 Temperament Score	0.14	0.20	0.23
D 56 Weight	0.03	-0.27	-0.14
D 56 Daily Feed Intake	0.02	-0.35**	-0.20
D 56 Average Daily Gain	-0.31*	0.04	-0.21
D 56 Feed Efficiency	0.30*	-0.19	0.11
D 56 Chute Score	-0.01	0.06	0.03
D 56 Exit Velocity	0.28	0.24	0.36**
D 56 Temperament Score	0.16	0.18	0.23
D 84 Weight	0.01	-0.28	-0.16
D 84 Daily Feed Intake	-0.17	-0.22	-0.26
D 84 Average Daily Gain	-0.08	-0.13	-0.14
D 84 Feed Efficiency	-0.05	-0.04	-0.06
D 84 Chute Score	-0.08	-0.01	-0.06
D 84 Exit Velocity	0.25	0.20	0.31*
D 84 Temperament Score	0.14	0.14	0.19
D 112 Weight	-0.02	-0.29*	-0.19
D 112 Daily Feed Intake	-0.18	-0.22	-0.27
D 112 Average Daily Gain	-0.20	-0.10	-0.21
D 112 Feed Efficiency	0.14	0.04	0.13
D 112 Chute Score	0.30*	-0.11	0.16
D 112 Exit Velocity	-0.14	-0.02	-0.12
D 112 Temperament Score	0.12	-0.10	0.03
D 140 Weight	-0.06	-0.29	-0.22
D 140 Daily Feed Intake	-0.20	-0.14	-0.24
D 140 Average Daily Gain	-0.17	-0.04	-0.15
D 140 Feed Efficiency	0.15	0.10	0.17
D 140 Chute Score	-0.12	-0.02	-0.10
D 140 Exit Velocity	0.06	0.01	0.05
D 140 Temperament Score	-0.05	-0.01	-0.04
D 168 Weight	-0.01	-0.24	-0.16
D 168 Daily Feed Intake	-0.23	-0.17	-0.27
D 168 Average Daily Gain	0.19	0.15	0.24
D 168 Feed Efficiency	-0.16	-0.24	-0.27
D 168 Chute Score	-0.06	0.04	-0.02
D 168 Exit Velocity	-0.07	0.07	-0.01
D 168 Temperament Score	-0.09	0.08	-0.02
Overall Weight	0.01	-0.28	-0.17
Overall Daily Feed Intake	-0.11	-0.28	-0.25
Overall Average Daily Gain	-0.03	-0.02	-0.03
Overall Feed Efficiency	-0.03	-0.24	-0.17
Overall Chute Score	0.25	0.00	0.19
Overall Exit Velocity	0.29*	0.68**	0.64**
Overall Temperament Score	0.34*	0.38**	0.49**

*= Significant Correlation ($P \leq 0.10$)
**= Significant Correlation ($P \leq 0.05$)

Feed efficiency was found to be correlated with temperament in steers (Table 4). Feed efficiency on days 28 ($P \leq 0.05$) was negatively correlated with weaning chute score and temperament score. Day 168 ($P \leq 0.1$) and overall feed efficiency ($P \leq 0.1$) was negatively correlated with weaning exit velocity. Day 56 feed efficiency was positively correlated ($P \leq 0.05$) with weaning chute score and also positively correlated ($P \leq 0.1$) with weaning temperament score. Daily feed intake on day 28 displayed a tendency ($P \leq 0.1$) to be correlated with steer weaning exit velocity.

In contrast to the steers whose feed efficiency showed correlations to temperament measurements, the heifer's feed intake was negatively correlated with temperament measurements. Heifers correlations can be found in table 5. Feed intake at day 56 ($P \leq 0.1$) was found to be negatively correlated with weaning exit velocity and day 84 feed intake ($P \leq 0.1$) was negatively correlated with weaning temperament score. Feed intake at day 112 was negatively correlated ($P \leq 0.1$) with weaning exit velocity and also negatively correlated ($P \leq 0.05$) with weaning temperament score. Day 140 feed intake ($P \leq 0.1$) was similarly negatively correlated with weaning temperament score. Feed intake on day 168 ($P \leq 0.05$) was negatively correlated with weaning chute score and weaning temperament score.

Table 4- Correlations between steer feedlot measurements and weaning temperament measurements

Steer Feedlot Measurements	Weaning Chute Score	Weaning Exit Velocity	Weaning Temperament Score
Weaning Weight	0.19	-0.46*	-0.07
D 0 Weight	0.18	-0.43	-0.07
D 0 Chute Score	-0.33	-0.36	-0.45*
D 0 Exit Velocity	0.05	0.33	0.21
D 0 Temperament Score	-0.25	-0.14	-0.28
D 28 Weight	0.26	-0.41	0.02
D 28 Daily Feed Intake	0.13	-0.46*	-0.12
D 28 Average Daily Gain	0.37	-0.07	0.27
D 28 Feed Efficiency	-0.54**	-0.36	-0.62**
D 28 Chute Score	-0.36	0.13	-0.24
D 28 Exit Velocity	0.25	0.07	0.24
D 28 Temperament Score	-0.15	0.15	-0.05
D 56 Weight	0.20	-0.40	-0.03
D 56 Daily Feed Intake	0.27	-0.04	0.20
D 56 Average Daily Gain	-0.42	0.04	-0.33
D 56 Feed Efficiency	0.58**	0.06	0.50*
D 56 Chute Score	0.07	-0.25	-0.07
D 56 Exit Velocity	0.21	0.09	0.22
D 56 Temperament Score	0.19	-0.10	0.19
D 84 Weight	0.17	-0.42	-0.06
D 84 Daily Feed Intake	-0.00	-0.04	-0.03
D 84 Average Daily Gain	-0.18	-0.02	-0.16
D 84 Feed Efficiency	0.15	-0.04	0.10
D 84 Chute Score	0.21	-0.01	0.17
D 84 Exit Velocity	0.22	0.13	0.24
D 84 Temperament Score	0.27	0.09	0.27
D 112 Weight	0.12	-0.39	-0.09
D 112 Daily Feed Intake	0.04	0.07	0.07
D 112 Average Daily Gain	-0.30	0.14	-0.18
D 112 Feed Efficiency	0.41	-0.13	0.27
D 112 Chute Score	0.34	0.09	0.33
D 112 Exit Velocity	-0.16	0.29	0.01
D 112 Temperament Score	0.06	0.31	0.20
D 140 Weight	0.10	-0.34	-0.09
D 140 Daily Feed Intake	-0.05	0.01	-0.04
D 140 Average Daily Gain	-0.07	0.18	0.03
D 140 Feed Efficiency	0.05	-0.34	-0.12
D 140 Chute Score	-0.22	0.45*	0.05
D 140 Exit Velocity	0.02	-0.23	-0.09
D 140 Temperament Score	-0.09	0.02	-0.06
D 168 Weight	0.21	-0.23	0.06
D 168 Daily Feed Intake	0.03	0.15	0.09
D 168 Average Daily Gain	0.28	0.33	0.40
D 168 Feed Efficiency	-0.10	-0.50*	-0.33
D 168 Chute Score	-0.34	-0.23	-0.40
D 168 Exit Velocity	0.05	-0.26	-0.09
D 168 Temperament Score	-0.10	-0.33	-0.24
Overall Weight	0.19	-0.40	-0.04
Overall Daily Feed Intake	0.08	-0.05	0.04
Overall Average Daily Gain	0.04	0.23	0.15
Overall Feed Efficiency	-0.07	-0.49*	-0.30
Overall Chute Score	0.15	-0.06	0.10
Overall Exit Velocity	0.34	0.47*	0.52**
Overall Temperament Score	0.34	0.22	0.39

*= Significant Correlation ($P \leq 0.10$)
**= Significant Correlation ($P \leq 0.05$)

Table 5- Correlations between heifer feedlot measurements and weaning temperament measurements

Heifer Feedlot Measurements	Weaning Chute Score	Weaning Exit Velocity	Weaning Temperament Score
Weaning Weight	-0.06	-0.20	-0.18
D 0 Weight	-0.09	-0.25	-0.24
D 0 Chute Score	0.29	-0.01	0.20
D 0 Exit Velocity	0.04	0.57**	0.41*
D 0 Temperament Score	0.19	0.40*	0.41*
D 28 Weight	-0.03	-0.25	-0.19
D 28 Daily Feed Intake	0.25	-0.25	0.01
D 28 Average Daily Gain	0.26	-0.09	0.12
D 28 Feed Efficiency	-0.06	-0.01	-0.05
D 28 Chute Score	0.05	0.11	0.11
D 28 Exit Velocity	0.39*	0.22	0.43*
D 28 Temperament Score	0.33	0.24	0.39*
D 56 Weight	-0.08	-0.24	-0.22
D 56 Daily Feed Intake	-0.09	-0.45*	-0.37
D 56 Average Daily Gain	-0.24	0.05	-0.14
D 56 Feed Efficiency	0.17	-0.28	-0.06
D 56 Chute Score	-0.08	0.20	0.08
D 56 Exit Velocity	0.33	0.32	0.45*
D 56 Temperament Score	0.14	0.29	0.29
D 84 Weight	-0.07	-0.26	-0.22
D 84 Daily Feed Intake	-0.30	-0.35	-0.45*
D 84 Average Daily Gain	0.01	-0.20	-0.12
D 84 Feed Efficiency	-0.34	-0.05	-0.28
D 84 Chute Score	-0.44*	0.00	-0.32
D 84 Exit Velocity	0.29	0.31	0.42*
D 84 Temperament Score	-0.03	0.23	0.13
D 112 Weight	-0.08	-0.28	-0.25
D 112 Daily Feed Intake	-0.35	-0.39*	-0.51**
D 112 Average Daily Gain	-0.10	-0.23	-0.23
D 112 Feed Efficiency	-0.06	0.11	0.03
D 112 Chute Score	0.27	-0.19	0.06
D 112 Exit Velocity	-0.10	-0.57**	-0.46**
D 112 Temperament Score	0.20	-0.36	-0.09
D 140 Weight	-0.13	-0.32	-0.31
D 140 Daily Feed Intake	-0.32	-0.25	-0.40*
D 140 Average Daily Gain	-0.24	-0.18	-0.29
D 140 Feed Efficiency	0.18	0.22	0.28
D 140 Chute Score	-0.13	-0.16	-0.20
D 140 Exit Velocity	0.23	0.34	0.39*
D 140 Temperament Score	-0.03	-0.02	-0.04
D 168 Weight	-0.10	-0.31	-0.28
D 168 Daily Feed Intake	-0.47**	-0.39	-0.60**
D 168 Average Daily Gain	0.13	0.06	0.13
D 168 Feed Efficiency	-0.38	-0.05	-0.30
D 168 Chute Score	0.12	0.14	0.18
D 168 Exit Velocity	-0.22	0.36	0.09
D 168 Temperament Score	-0.07	0.36	0.19
Overall Weight	-0.08	-0.28	-0.24
Overall Daily Feed Intake	-0.24	-0.42*	-0.45*
Overall Average Daily Gain	-0.07	-0.28	-0.24
Overall Feed Efficiency	0.04	-0.07	-0.02
Overall Chute Score	0.30	0.03	0.24
Overall Exit Velocity	0.27	0.74**	0.69**
Overall Temperament Score	0.35	0.45*	0.55**

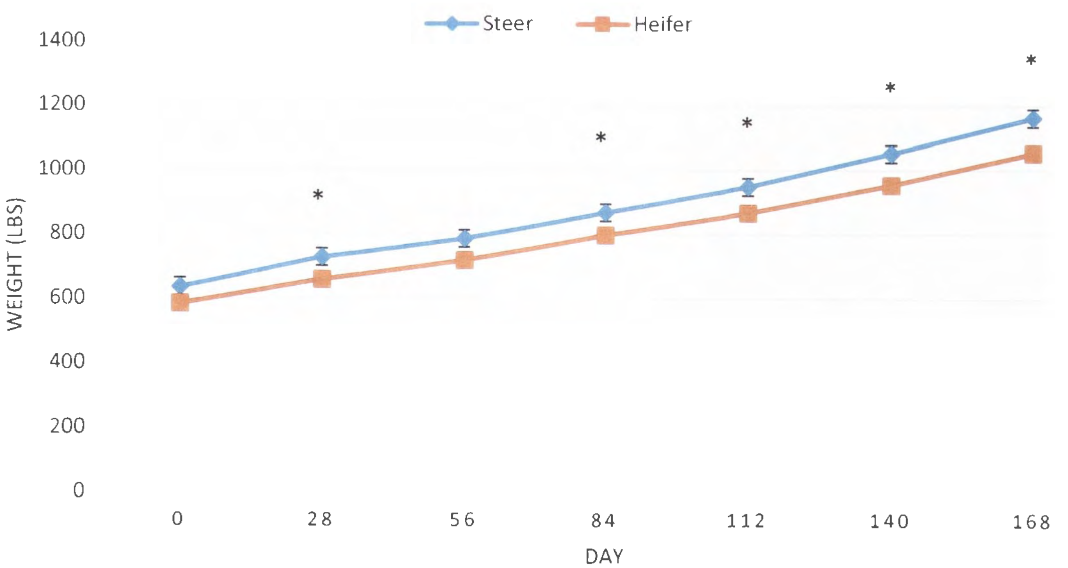
*= Significant Correlation ($P \leq 0.10$)
**= Significant Correlation ($P \leq 0.05$)

Although there were select areas within each group that were correlated with temperament, overall there was little evidence that feedlot performance is affected by weaning temperament. Behrends et al. (2009) explains that the variations in temperament might be masked when handling stress is minimal. Similar to this, Busby et al. (2006) reports that feedlot performance can be impacted by temperament, however, carcass quality is the most affected by temperament.

Sex Differences in Weight

Weight differed between sex classes during the feedlot period. Steer weights on day 28 were on average 69.5 lbs heavier than heifers (P=.0463). This trend continues until day 168 when steers are on average 108.5 lbs heavier than heifers(P=0.0027). Figure 3 shows relationship between sex class and weight over 168 day period. In a study by Hedrick et al. (1969), it was found that steers generally had heavier total weights than heifers.

Figure 3- Weight by Day and Sex



* Within day steers and heifer differ (P<0.05). Means within days lacking astericks do not differ between steers and heifers (P>0.05).

Sex and Day Effect on Feedlot Performance Measurements

Steers tended to eat more food than heifers (P=0.089) throughout the trial. They also gained more weight per day than the heifers (P=0.007) which is to be expected given that steers had larger day 168 weights and similar day 0 weights. This finding is also consistent with previous research by Ray et al. (1969) and Zinn et al. (2015) who found that steers gained faster than heifers. However, sex had little effect on feed efficiency (P=0.983). Ray et al. (1969) supports this finding by reporting that feed conversion was comparable between the sexes. It was found by Lusby et al. (1985) that steers responded to implants better than heifers and had better feed efficiency.

Table 6- Sex Effect on Feedlot Performance Measurements

	Steer	Heifer	SEM	P-Value
Daily Feed Intake	38.55	36.17	1.32	0.089
Average Daily Gain	3.14	2.8	0.09	0.007
Feed Efficiency	14.51	14.53	0.59	0.983

As was expected feedlot performance measurements differed over time (P<0.0001). Feed intake increased until day 112 when a higher concentrate ration was implemented (refer to Table 1). at that point daily feed intake decreased. Zinn et al. (2015) also found that as energy concentration of a diet increased. feed intake decreased. At the same time point average daily gain increased and feed efficiency improved.

Table 7- Day Effect on Feedlot Performance Measurements

	28	56	84	112	140	168	SEM	P-Value
Daily Feed Intake	32.65	39.6	41.45	41.21	36.64	32.61	1.19	<0.0001
Average Daily Gain	2.96	2.11	2.89	2.64	3.45	3.78	0.14	<0.0001
Feed Efficiency	12.84	20.22	15.01	17.07	12.12	9.88	0.98	<0.0001

Implications

This study found that within heifers increased temperament scores led to a decrease in daily feed intake. Since feed efficiency was not different between steers and heifers, the smaller amount of feed consumed could have resulted in the large difference in weight gain. That knowledge could assist feedlot managers work more closely with heifers to ensure that they are stressed as little as possible which could potentially shrink the weight gap between steers and heifers.

For cow-calf producers, the knowledge that temperament scores could affect feedlot performance would give them a simple method of improving their herds. Given that temperament is moderately heritable, selection for temperament would quickly improve the herd average and by extension the herd's feedlot performance. Temperament data could also help producers select which animals to keep as replacement heifers and which to send to the feedlot. It could be speculated that slightly temperamental animals would make better mothers and the calmer animals would perform better in the feedlot. Additional research is needed to validate those speculations.

Acclimation to handling is also favorable for producers and feedlots. As time goes on and animals become used to human presence, they will perform better in the feedlot and be less aggressive or stressed. This could result in better carcasses and a safer working environments for humans and animals.

Reflective Writing

My capstone project began the summer before my senior year. I was in the meat science lab as an undergraduate student lab assistant, which is a slightly odd place for an animal science major, but it was a good learning experience. As a part of the nutrition science lab, I was able to attend a meat science conference on the undergraduate quiz bowl team. Although the quiz bowl did not go as planned (we lost every match), it got me interested in meat science and the relationship between the live animal and the eventual food that humans eat. In most colleges meat science is in the animal science program, so it wasn't too far of a stretch for me to learn more about it.

As my summer progressed I began helping one of the graduate students with his project. This project was observing what happens when the nutrition of a cow is restricted during her second trimester of pregnancy. It sought to answer questions such as how the calf would grow and if it would display differences from the maintenance calves. I realized that I was quite interested with this process and I wanted to become involved to some degree.

As the summer began winding down I spoke with the man who was in charge of that lab that I was working in, Dr. Jerrad Legako. I asked him if there was some part of the research that I might be able to use as my senior thesis for Honors. After I explained a little bit about the Honors program and the requirements, Dr. Legako agreed that I could work with the animals and research temperament differences. There had been previous research regarding the temperament of animals (how they handle stress and how calm they are) and how that affects their growth and carcass traits. Dr. Legako wanted to perform similar research on these calves when they entered the feedlot. That would be my senior thesis.

Unfortunately the calves wouldn't enter the feedlot until early November, so there was a large period of my senior year that I had not even started my thesis. I obviously began researching past research and other documents, but it was a long time before I even got started with the field research.

Once November finally came the calves entered the feedlot and that began the very tedious job of feeding the animals every day. I would have to measure the amount of feed given to each individual animal (35 animals), and then come back the next day to measure how much feed was remaining. This gave me the amount of food eaten by the animal for that day. This process continued through Thanksgiving and Christmas and most of spring semester (a total of 168 days). Thankfully there were other students who helped me feed, otherwise it would have been an overwhelming task.

Multiple challenges came from this feeding process, such as equipment breaking, feed not being ready when it needed to be and many others. For instance, 11 of the animals were housed outside, so their feed bunk was exposed to whatever weather might be occurring at the moment. At times the feed would be covered in snow so we would have to sift through the snow to find the feed, (while the freezing wind was blowing out of the canyons), and other times the rain created puddles in the feed bunk so we had to take the water weight into account when weighing the feed that was left over. Challenges are to be expected when working in the real world so it was good that all of those challenges were able to be overcome.

Upon entering the feedlot, temperament measurements and ultrasounds were taken. The ultrasound readings measured the size of the ribeye area and the backfat thickness. This takes an experienced and trained operator to take these readings, so once again I was saved by having great assistance from one of my old professors, Brett Bowman.

Unfortunately, due to some issues with the formats of the readings and some other problems, I was unable to include the ultrasound data in my project. That was rather disappointing to me since I thought it was going to be a large part of my data. I was also very interested with what it was going to show.

Temperament scores and ultrasound readings were taken at 28 day intervals throughout the feedlot, so a lot of data was collected. Which leads to the next challenge, processing all of the data. I really had no idea what to do with most of the data. I had read many papers and had seen what they presented in those papers. But it is much different to have the raw data and try to make sense out of it. I had taken a statistics class, but that was far different from what I would be required to do in order to make the data readable. Dr. Legako was invaluable in that area. From SAS tests and ANOVA, he was willing to assist me with all of the statistical data that I had and how to present it so that it made sense. Some information would look better in a table and other data would look better in a graph. Similarly, there were some things I had not thought of comparing, such as the different genders. Dr. Legako helped me out with all of these areas and more.

Overall, it probably would have been less stressful if I could've begun my project a little earlier than November. Then my data would have been available sooner and I would not have needed to stress about completing my project in time. I also got a little greedy and included a lot of data in my project. The grad student who I worked with during the summer included 84 days of the feedlot in his masters thesis (and a lot of other data as well). I doubled that and included 168 days of data in my thesis. This meant that the last day of data I included in my project was April 21st; a mere 2 weeks before the thesis is due. That meant that I had a lot of data crunching to do in that short amount of time. Probably not the best idea in reflection, but it made for a complete picture of the animal's time in the feedlot.

Despite some of the challenges, I learned a lot about research and myself. Research is a lot more fulfilling when you are interested in the subject matter. However, I probably will not seek a career with large amounts of researching. Although, I don't think my time here at Utah State would have been complete without this thesis and the Honors program in general.

Word Count of Reflection: 1130

References

Behrends, S. M., R. K. Miller, F. M. Rouquette, R. D. Randel, B. G. Warrington, T. D. a Forbes, T. H. Welsh, H. Lippke, J. M. Behrends, G. E. Carstens, and J. W. Holloway. (2009). Relationship of temperament, growth, carcass characteristics and tenderness in beef steers. *Meat Sci.* 81:433–438.

Burrow, H. M., & Dillon, R. D. (1997). Relationships between temperament and growth in a feedlot and commercial carcass traits of Bos indicus crossbreds. *Animal Production Science*, *37*(4), 407-411.

Burrow, H. M., G. W. Seifert, and N. J. Corbet. (1988). A new technique for measuring temperament in cattle. *Proc. Aust. Soc. Anim. Prod.* Vol. 17.

Busby, W. D., Strohbehn, D. R., Beedle, P., & King, M. (2006). Effect of disposition on feedlot gain and quality grade. *Animal Industry Report*, *652*(1), 16.

Cafe, L. M., Robinson, D. L., Ferguson, D. M., McIntyre, B. L., Geesink, G. H., & Greenwood, P. L. (2011). Cattle temperament: persistence of assessments and associations with productivity, efficiency, carcass and meat quality traits. *Journal of animal science*, *89*(5), 1452-1465.

Cooke, R. F., Arthington, J. D., Araujo, D. B., & Lamb, G. C. (2009). Effects of acclimation to human interaction on performance, temperament, physiological responses, and pregnancy rates of Brahman-crossbred cows. *Journal of animal science*, *87*(12), 4125-4132.

Grandin, T. (1993). Behavioral agitation during handling of cattle is persistent over time. *Applied Anim. Behavior Sci.* 36:1-9.

Hearnshaw, H., & Morris, C. A. (1984). Genetic and environmental effects on a temperament score in beef cattle. *Crop and Pasture Science*, *35*(5), 723-733.

Hedrick, H. B., Thompson, G. B., & Krause, G. F. (1969). Comparison of feedlot performance and carcass characteristics of half-sib bulls, steers and heifers. *Journal of animal science*, *29*(5), 687-694.

Kadel, M. J., Johnston, D. J., Burrow, H. M., Graser, H. U., & Ferguson, D. M. (2006). Genetics of flight time and other measures of temperament and their value as selection criteria for improving meat quality traits in tropically adapted breeds of beef cattle. *Crop and Pasture Science*, *57*(9), 1029-1035.

King, D. a., C. E. Schuehle Pfeiffer, R. D. Randel, T. H. Welsh, R. a. Oliphint, B. E. Baird, K. O. Curley, R. C. Vann, D. S. Hale, and J. W. Savell. (2006). Influence of animal temperament and stress responsiveness on the carcass quality and beef tenderness of feedlot cattle. *Meat Sci.* 74:546–556.

Krohn, C. C., J. G. Jago, and X. Boivin. (2001). The effect of early handling on the socialisation of young calves to humans. *Appl. Anim. Behav. Sci.* 74:121–133.

Lusby, K.S., D.R. Gill. (1985). Implanting beef cattle. Great Plains Extension, GPE-1603, Factsheet p. 1–4

Ray, D. E., Hale, W. H., & Marchello, J. A. (1969). Influence of season, sex and hormonal growth stimulants on feedlot performance of beef cattle. *Journal of animal science*, *29*(3), 490-495.

Sewell, H. B. (1993). Growth stimulants (implants). *Extension publications (MU).*

Tulloh, N. M. (1961). Behaviour of cattle in yards. II. A study of temperament. *Animal Behaviour*, *9*(1), 25-30.

Vann, R.C., J.A. Parish, and W. B McKinley. (2008). Case Study: Mississippi cattle producers gain insight into temperament effects on feedlot performance and subsequent meat quality. *Prof. Anim. Sci.* 24:628-633.

Vetters, M. D. D., Engle, T. E., Ahola, J. K., & Grandin, T. (2013). Comparison of flight speed and exit score as measurements of temperament in beef cattle. *Journal of animal science*, *91*(1), 374-381.

Voisinet, B. D., T. Grandin, J. D. Tatum, S. F. O'Connor, and J. J. Struthers. (1997). Feedlot Cattle with Calm Temperaments Have Higher Average Daily Gains Than Cattle with Excitable Temperaments. *J. Anim. Sci.* 75:892–896.

Zinn, R. A., Barreras, A., Owens, F. N., & Plascencia, A. (2008). Performance by feedlot steers and heifers: Daily gain, mature body weight, dry matter intake, and dietary energetics. *Journal of animal science*, *86*(10), 2680-2689.

Author Biography

Growing up in Southern Oregon, Jeffrey Briscoe became interested in agriculture from a young age. Helping out his dad by driving tractor when he was 7 and playing with the horses even younger than that ensured that agriculture would become a large part of his life. So when decided where to attend college, the great College of Agriculture at Utah State University made his choice easy. The Presidential Scholarship was a nice perk as well. Majoring in Animal Science with a minor in agri-business opened up many opportunities for Jeffrey. He attended multiple conferences and was a part of a few organizations within the College of Agriculture and Applied Sciences. Throughout his time at USU, Jeffrey was on the Dean's List 4 different times and was awarded the "A" Pin his senior year. This award is given for 2 consecutive semesters of 4.0 GPA with at least 15 credits. Jeffrey has accepted an internship with IFA's North Region Feed Division working on a project and assisting throughout the many departments. Once that internship is completed Jeffrey will either find a job or attend grad school to further his education. Eventually Jeffrey plans to work within agricultural policy to ensure that the industry remains productive and the people within the industry continue to thrive.