

Temperament Can Be an Indicator of Feedlot Performance and Carcass Merit in Beef Cattle

K.E. Bates, R.L. Weaber, J.M. Bormann, D.W. Moser, J.L. Salak-Johnson¹, C.C.L. Chase², R.K. Peel³, H. Van Campen⁴, G.H. Loneragan⁵, J.J. Wagner³, P. Bodhireddy⁶, K. Prayaga⁶, and R.M. Enns³

Introduction

Cattle producers historically have selected for docile temperaments simply for management convenience because calmer animals are conducive to safe environments for their peers as well as their handlers. As many producers would acknowledge, however, there seems to be a relationship between temperament and cattle health, and calmer cattle tend to frequent the working chute for treatment of disease less often.

Positive correlations have been found in cattle between temperament traits (chute scores, pen scores, and chute exit velocities) and cortisol concentration in the blood, suggesting that more excitable cattle are easily stressed (Curley et al., 2006; Cooke et al., 2009). Curley et al. (2007) also found that easily excitable animals sustain elevated cortisol concentrations for a longer duration and have greater pituitary and adrenal responses following a stressor than calm cattle. Temperamental cattle have significantly higher mean temperament responses at all points (Oliphint, 2006). Higher basal serum cortisol concentrations may suggest that easily excitable cattle are chronically stressed (Curley et al., 2007), possibly resulting in a compromised immune system, illness, and decreased fat and protein deposition. This study was conducted to further investigate the relationships between cattle temperament (measured by chute score and exit velocity), immunological factors, and a range of economically relevant performance traits.

Experimental Procedures

The Colorado State University Animal Care and Use Committee approved all experimental procedures. Crossbred steers were provided by a single-source ranch with three locations in western Nebraska. In Year 1 (2007), 1,551 cattle were provided, and 1,319 cattle were provided in Year 2 (2008). In November of each year, cattle were shipped 333 miles to a commercial feedlot in southeastern Colorado and were processed within 2 days of arrival to the feedlot. Initial processing included the administration of a radio frequency and visual identification tag, an oral and pour-on parasiticide, and an implantation of a growth promotant. At this time, a blood sample was taken and weight was recorded. Cattle were not vaccinated in Year 1 so that all animals could be equally challenged; however, 45% of animals experienced bovine respiratory disease (BRD). To avoid similar costs in Year 2, cattle were vaccinated for BRD with Pyramid 2 +

¹ Department of Animal Sciences, University of Illinois, Urbana, IL.

² Department of Veterinary and Biomedical Sciences, South Dakota State University, Brookings, SD.

³ Department of Animal Sciences, Colorado State University, Fort Collins, CO.

⁴ Department of Microbiology, Immunology, and Pathology, Colorado State University, Fort Collins, CO.

⁵ Department of Food Safety and Public Health, Texas Tech University, Lubbock, TX.

⁶ Zoetis, Kalamazoo, MI.

Type II BVD and Presponse SQ (both from Boehringer Ingelheim, St. Joseph, MO). Cattle were processed again at the time of re-implantation (~day 74) and a third time at approximately day 140. At both of these processing points, weights of the animals were recorded. Growth calculations included the gain between the first and second processing dates (GAIN1), the amount of gain between the second and third processing (GAIN2), and the total gain between the time of feedlot placement and the third processing.

Temperament was assessed using chute score (Grandin, 1993; BIF, 2002) and exit velocity (Burrow et al., 1988) at the first two processing dates. When a steer was restrained in the chute, two evaluators assigned a chute score to the animal. The chute score scale ranged from 1 to 6, where calmer animals were on the lower end of the scale and the most aggressive cattle were at the upper end. The two appraised chute scores were averaged, and chute score was treated as a continuous variable for analysis. Upon release from the chute, the flight time, or the time it takes an animal to cover a defined distance (6 feet), was recorded. Flight time was then converted to exit velocity in units of feet/second.

Cattle were harvested at day 225 on average at JBS Swift and Company plants in Dumas, TX, and Greeley, CO, in Year 1 and 2, respectively. Data recorded at this time included hot carcass weight, calculated yield grade, USDA quality grade, marbling score, ribeye area, and lung score. Two trained evaluators assigned a lung score of the aggregate lung. Lung scores were based on a scale of 0 to 3, where lower scores indicated less lung damage due to respiratory disease.

Assays were performed using the blood sample taken at the time of feedlot placement to determine cortisol and interleukin 8 concentrations in the blood. Both were measured using commercially available kits. Plasma cortisol was measured using a radioimmunoassay following the manufacturer's protocol (Coat-A-Count; Diagnostic Products, Los Angeles, CA). Interleukin 8 was measured using human ELISA kits that have been previously reported to cross-react with bovine interleukin 8 (Shuster et al., 1996, 1997; R&D Systems, Inc., Minneapolis, MN).

Statistical analysis of phenotypic measures was performed in SAS (SAS Institute, Cary, NC). Contemporary group ($n = 11$) accounted for differences in initial ranch unit, feedlot placement date, feedlot pen, and all processing dates. For all analyses, fixed effects were pre-feedlot BRD treatment and contemporary group. To determine least squares means using the general linear mixed model, BRD treatment in the feedlot was also included as a fixed effect. The multivariate analysis of variance procedure was used to determine correlations among quantitative variables. Odds ratios were produced using the logistic regression procedure with qualitative response variables.

Results and Discussion

Cortisol had a weak but significant correlation with all temperament measures except exit velocity at the time of feedlot placement (Table 1). Positive relationships between circulating cortisol concentrations and temperament have been reported previously, confirming that more excitable animals have significantly greater cortisol concentra-

tions than their calmer peers (Curley et al., 2006; King et al., 2006; Stahringer et al., 1990).

Growth measures, including weights and gains, had few significant correlations with temperament traits, all of which were weak and negative (Table 1). This result suggests that more excitable cattle will weigh and gain less throughout the finishing phase than their calmer peers. Carcass traits also had few significant correlations with measures of temperament, and all that were significant were negative (Table 1). Appraised exit velocity at the time of re-implantation was negatively associated with hot carcass weight and yield grade. Chute score at the time of feedlot placement had a small negative correlation with marbling score, suggesting that temperamental cattle at the time of feedlot arrival will have decreased intramuscular fat deposition compared with their calmer peers.

All correlations were significant among temperament measures, and the strongest correlation was between exit velocity at feedlot placement and exit velocity at re-implantation (Table 2). Repeatabilities of the two temperament measures indicated that exit velocity ($r_p = 0.41 \pm 0.02$) was more repeatable than chute score ($r_p = 0.17 \pm 0.02$), which may be due to the objective nature of exit velocity.

Implications

Results from this study indicate that more temperamental cattle will have slightly worse feedlot performance and carcass merit than their calmer peers.

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Table 1. Partial correlation coefficients of temperament traits with measures of immunity

Trait	Chute score 1 ¹	Chute score 2 ²	Exit velocity 1 ³	Exit velocity 2 ⁴
Cortisol ⁵	0.0720**	0.0754**	0.0372	0.1120***
IL-8 ⁶	-0.0110	-0.0257	0.0157	0.0437
Wt. 1 ⁷	0.0255	0.0134	-0.0084	-0.0262
Wt. 2 ⁸	-0.0115	-0.0123	-0.0447	-0.1049***
Wt. 3 ⁹	-0.0233	-0.0404	-0.0588*	-0.1113***
Gain 1 ¹⁰	-0.0335	-0.0253	-0.0480	-0.1080***
Gain 2 ¹¹	-0.0221	-0.0492*	-0.0336	-0.0344
Total gain ¹²	-0.0449	-0.0575*	-0.0656*	-0.1174***
Hot carcass weight	0.0185	-0.0236	-0.0371	-0.0799***
Yield grade	-0.0280	-0.0378	-0.0147	-0.0718**
Marbling score ¹³	-0.0643**	-0.0141	-0.0178	-0.0445
Ribeye area	0.0226	0.0093	-0.0088	0.0125
Lung ¹⁴	0.0375	0.0040	-0.0090	-0.0111

¹ Average chute score at the time of feedlot placement (first processing).

² Average chute score at the time of re-implantation (second processing).

³ Exit velocity at the time of feedlot placement.

⁴ Exit velocity at the time of re-implantation.

⁵ Circulating serum cortisol concentration at the time of feedlot placement.

⁶ Circulating interleukin-8 concentration at first processing.

⁷ Body weight recorded at first processing.

⁸ Body weight recorded at second processing.

⁹ Body weight recorded at third processing.

¹⁰ Gain between the first and second processing.

¹¹ Gain between second and third processing.

¹² Total gain between the first and third processing.

¹³ Slight = 300 to 399, Small = 400 to 499, and Modest = 500 to 599.

¹⁴ Average lesion score of the aggregate lung.

* $P < 0.05$; ** $P < 0.01$; and *** $P < 0.001$.

Table 2. Correlation matrix with the partial correlation coefficients and associated significance of exit velocity and chute score at placement and re-implantation

Trait	Chute score 1 ¹	Chute score 2 ²	Exit velocity 1 ³	Exit velocity 2 ⁴
Chute score 1 ¹	1.000			
Chute score 2 ²	0.2351***	1.000		
Exit velocity 1 ³	0.1406***	0.1803***	1.000	
Exit velocity 2 ⁴	0.1373***	0.2223***	0.4448***	1.000

* $P < 0.05$; ** $P < 0.01$; and *** $P < 0.001$.