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EFFECTS OF ACCLIMATION TO HUMAN HANDLING ON TEMPERAMENT, PHYSIOLOGICAL RESPONSES, AND PERFORMANCE OF BEEF STEERS DURING FEEDLOT RECEIVING

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ABSTRACT: The objective was to compare temperament, plasma concentrations of cortisol and acute-phase proteins, and performance during feedlot receiving of Angus × Hereford steers acclimated or not to human handling. Sixty steers were initially evaluated, within 30 d after weaning, for BW and temperament score (average chute score and exit velocity score; d -30). On d -28, steers were ranked BW and temperament score, and randomly assigned to receive or not (control) the acclimation treatment. During the acclimation phase (d -28 to 0), steers were maintained in 2 pastures according to treatment, and acclimated steers were exposed to a handling process twice weekly (Tuesdays and Thursdays). The acclimation treatment was applied individually to steers by processing them through a handling facility, whereas control steers remained undisturbed on pasture. On d 0, all steers were loaded into a commercial livestock trailer, transported for 24 h, and returned to the research facility (d 1). Upon arrival, steers were ranked by BW within treatment, and randomly assigned to 20 feedlot pens. Total DMI was evaluated daily from d 1 to d 28, and shrunk BW was collected on d -31, 1, and 29 for ADG calculation. Blood samples were collected on d -28, 0 (prior to loading), 1 (immediately upon arrival), 4, 7, 10, 14, 21, and 28 for determination of cortisol, ceruloplasmin, and haptoglobin. Steer temperament was assessed again on d 0. During the acclimation phase (d -28 to 0), no treatment effects were detected ($P = 0.14$) on steer ADG. Acclimated steers had reduced chute score compared with control on d 0 ($P = 0.01$). During feedlot receiving (d 1 to 28), acclimated steers had reduced ADG ($P < 0.01$), DMI ($P = 0.07$), and G:F ($P = 0.03$) compared with control. Acclimated steers had greater plasma cortisol on d 1 ($P = 0.06$), greater haptoglobin on d 4 ($P = 0.04$), and greater ceruloplasmin from d 0 to 10 ($P \leq 0.04$) compared with control. In conclusion, steers exposed to the acclimation process had greater stress-induced cortisol and acute-phase protein responses, resulting in decreased performance during feedlot receiving.

INTRODUCTION

Temperament is defined as the behavioral responses of cattle when exposed to human handling (Burrow, 1997; Burrow and Corbert, 2000; Curley et al., 2006). Animals with aggressive temperament display nervous or agitated responses during human contact or any other handling procedures. Besides personnel security and animal welfare, temperament has significant implications on beef cattle performance. Our research group was the first to report that beef cows with aggressive temperament have impaired reproductive performance compared with cows with adequate temperament (Cooke et al., 2009a, 2012). In addition, our group recently reported that aggressive beef calves are lighter and consequently less valuable if sold at weaning, and also have decreased growth rates during the feedlot, resulting in reduced carcass marbling, carcass weight, and final carcass value if marketed upon slaughter (Cooke et al., 2011). Therefore, cattle temperament should be used as a management decision criterion to enhance overall productivity and safety of beef operations.

Temperament of feeder calves can be improved by two main strategies. The first is to select the cowherd for calm temperament, which should also benefit the calf crop given that temperament is a heritable trait (Fordyce et al., 1988). Second, recent studies from our group demonstrated that acclimation of young cattle to human handling improved their temperament and enhanced their productivity (Cooke et al., 2009b, 2012). However, this method was only tested with replacement heifers by evaluating their reproductive development. Based on this information, we hypothesized that acclimation to human interaction after weaning will also improve temperament and feedlot productivity of feeder steers. Therefore, the objective of this study was to compare temperament, plasma concentrations of cortisol and acute-phase proteins, and performance during feedlot receiving of steers acclimated or not to human interaction after weaning.

MATERIALS AND METHODS

The study was conducted at the Eastern Oregon Agricultural Research Center, Burns. Animals utilized were cared for according to an approved Oregon State University Animal Care and Use protocol.

Sixty Angus x Hereford steers were initially evaluated, within 30 d after weaning, for BW and temperament score (average chute score and exit velocity score). Chute score was assessed based on a 5- point scale according to the method described by Arthington et al. (2008). Exit velocity was assessed by determining the speed of the steer exiting the squeeze chute by measuring rate of travel over a 1.8-m distance with an infrared sensor (FarmTek Inc., North Wylie, TX). Further, steers were divided in quintiles and assigned an exit velocity score on a 5-point scale (1 = slowest quintile; 5 = cows within the fastest quintile). On d -28, steers were ranked BW and temperament score and randomly assigned to receive or not (control) the acclimation treatment. Steers were maintained on separate meadow foxtail (*Alopecurus pratensis* L.) pastures (30 steers/pasture) according to treatment, and received supplemental alfalfa hay 3 times weekly to sustain a growth rate of approximately 0.5 kg/d. The acclimation treatment was applied individually to steers by processing them through a handling facility, twice week (Tuesdays and Thursdays) for 4 wk, while control steers remained undisturbed on pasture. In addition, during feeding procedures, the technician walked among steers assigned to the acclimation treatment for 15 min to further expose them to human interaction, whereas the same procedure was not applied to control steers.

On d 0, all steers were loaded into a commercial livestock trailer, transported for 24 h for a total of 1,200 km, and returned to the research facility on 1. Upon arrival, steers were ranked by BW within treatment, and randomly assigned to 20 feedlot pens (10 pens/treatment; 3 steers/pen). All pens received 2.5 kg/steer daily of a concentrate (86% corn; 14% soybean meal), whereas meadow foxtail hay was offered in amounts to ensure ad libitum access. Total DMI was evaluated daily from d 1 to d 28, and shrunk BW was collected on d -31, 1, and 29 for ADG calculation. Total DMI and BW gain from d 1 to 28 were used to calculate feedlot receiving G:F.

Blood samples were collected on d -28, 0 (prior to loading), 1 (immediately upon arrival), 4, 7, 10, 14, 21, and 28 via jugular venipuncture into commercial blood collection tubes containing sodium heparin (Vacutainer, 10 mL; Becton Dickinson, Franklin Lakes, NJ). Steer rectal temperature (**RT**) was measured by digital thermometer (GLA M750 digital thermometer; GLA Agricultural Electronics, San Luis Obispo, CA) concurrently with each blood collection. All blood samples were harvested for plasma and stored at −80°C until assayed for concentrations of cortisol (Endocrine Technologies Inc., Newark, CA), haptoglobin (Cooke and Arthington, 2012) and ceruloplasmin (Demetriou et al., 1974).

Data were analyzed using the PROC MIXED procedure (SAS Inst. Inc., Cary, NC) and Satterthwaite approximation to determine the denominator df for the tests of fixed effects. The model statement used for ADG contained the effects of treatment. Data were analyzed using steer(treatment × pen) as random variable. The model statement used for DMI and G:F contained the effects of treatment, as well as day and the resultant interaction for DMI only. Data were analyzed using pen(treatment) as the random variable. The model statement used for temperament and physiological measurements contained the effects of treatment, day, and the resultant interactions. Data were analyzed using steer(treatment × pen) as the random variable. The specified term for repeated statements was day, pen(treatment) or steer(treatment × pen) as subject for DMI or temperament and physiological variables, respectively, and the covariance structure utilized was based on the Akaike information criterion. Results are reported as least square means and were separated using LSD. Significance was set at $P \leq 0.05$ and tendencies were determined if $P > 0.05$ and $P \leq 0.10$. Results are reported according to treatment effects if no interactions were significant, or according to the highest-order interaction detected.

RESULTS AND DISCUSSION

During the acclimation phase (d -28 to 0), no treatment effects were detected ($P = 0.14$) on steer ADG (Table 1). On d 0, acclimated steers had reduced ($P = 0.01$) chute score, and tended ($P = 0.08$) to have reduced temperament score compared with control cohorts (Table 1). However, during feedlot receiving (d 1 to d 28), acclimated steers tended ($P = 0.07$) to have reduced DMI, and had reduced ($P \leq 0.03$) ADG and G:F compared with control cohorts (Table 1). Similarly to our previous work (Cooke et al., 2009b, 2012), acclimation to handling improved temperament of growing cattle. However, steers exposed to the acclimation process experienced reduced feedlot receiving performance compared with control cohorts. This performance outcome was unexpected given that a similar acclimation process enhanced reproductive and overall performance of replacement heifers (Cooke et al., 2009b, 2012).

No treatment effects were detected ($P > 0.24$; data not shown) for RT (38.84 vs. 39.03ºC for ACC and CON steers, respectively; SEM = 0.07). Treatment x day interactions were detected for cortisol, haptoglobin, and ceruloplasmin ($P \leq 0.05$). Acclimated steers had greater plasma cortisol on d 1 ($P = 0.05$), greater haptoglobin on d 4 ($P = 0.04$), and greater ceruloplasmin from d 0 to 10 ($P \leq 0.04$) compared with control

Table 1. Temperament and feedlot receiving performance of beef steers exposed (ACC) or not (CON) to handling acclimation procedures[1]

Item	ACC	CON	SEM	*P* =
Temperament variables[2]				
Chute score	1.63	2.07	0.12	0.01
Exit velocity, m/s	1.97	2.28	0.16	0.18
Temperament score	2.21	2.63	0.16	0.08
Performance variables				
Total DMI, kg/d	7.09	7.40	0.11	0.07
Acclimation ADG,[3] kg/d	0.27	0.38	0.06	0.14
Receiving ADG,[4] kg/d	1.13	1.32	0.05	< 0.01
G:F,[5] kg/kg	166	185	6	0.03

[1] Acclimated steers were exposed to a handling process twice week for 4 wk (d -28 to 0), which was applied individually to steers by processing them through a handling facility. Control steers remained undisturbed on pasture.
[2] Obtained on d 0. Chute score (1 to 5 scale), exit velocity, and temperament score were calculated according to the techniques described by Cooke et al. (2011).
[3] Calculated using shrunk values obtained on d -31 and d 1.
[4] Calculated using shrunk values obtained on d 1 and d 29.
[5] Calculating using total DMI and BW gain from d 1 to d 29.

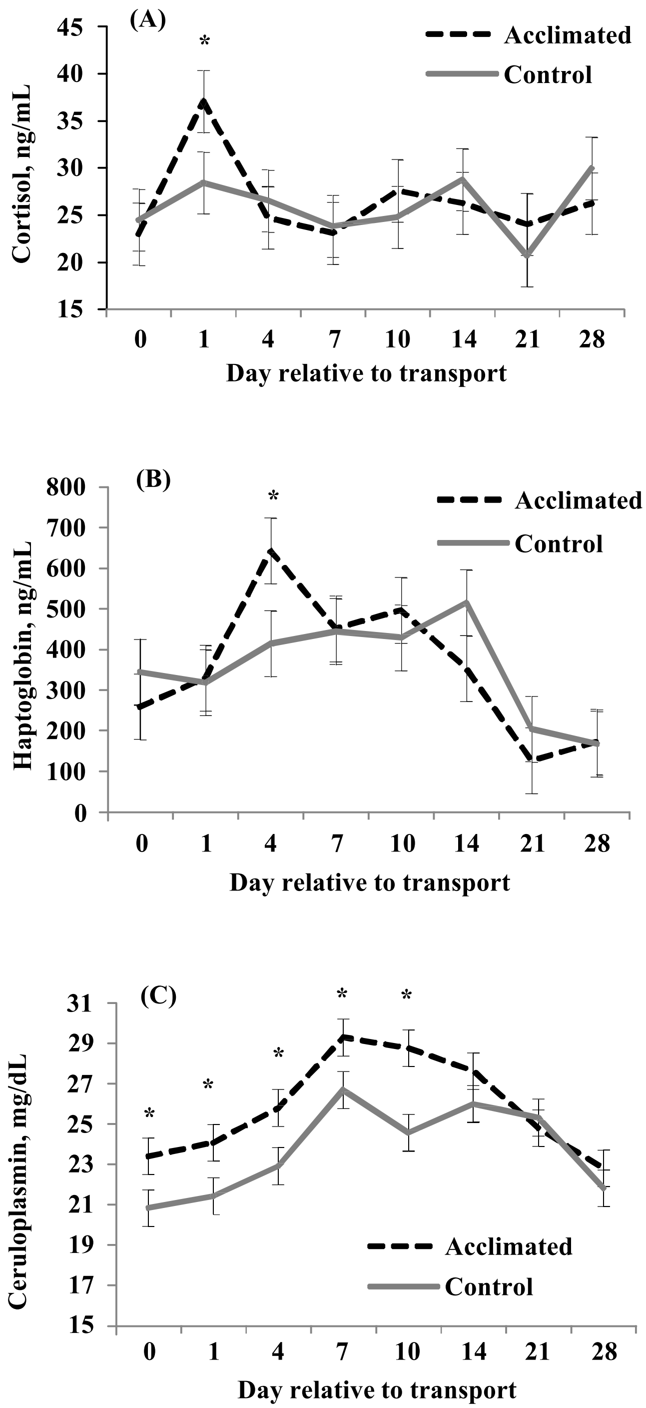

Figure 1. Plasma concentrations of cortisol (Panel A), haptoglobin (Panel B), and ceruloplasmin (Panel C) during feedlot receiving (d 1 to d 28) of beef steers exposed (acclimated) or not (control) to handling acclimation procedures (d -28 to 0) and transported for 24 h (d 0 to d 1). A treatment × day interaction was detected ($P \leq 0.05$) for all variables. Treatment comparison within day; * $P < 0.05$.

steers (Figure 1). Contrary to these outcomes, replacement heifers assigned to a similar acclimation process had reduced cortisol (Cooke et al., 2009b) and haptoglobin (Cooke et al., 2012). The exact reasons for the different outcomes to the acclimation process reported herein and by our previous work are unknown and deserve further investigation. Nevertheless, steers assigned to the acclimation process had a more severe neuroendocrine stress and acute-phase protein response upon transportation and feedlot entry compared with control cohorts, which likely contributed to their reduced DMI, G:F, and ADG during feedlot receiving (Arthington et al., 2003; Qiu et al., 2007; Araujo et al., 2010).

IMPLICATIONS

Acclimation of feeder steers to human handling after weaning improved cattle temperament but increased the neuroendocrine stress and acute-phase responses following transport and feedlot entry, resulting in decreased performance during feedlot receiving.

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