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Quality of handling and holding yard environment, and beef cattle temperament: 2. Consequences for stress and productivity

J. Carol Petherick [a,b,*], Vivienne J. Doogan [a,c], Bronwyn K. Venus [a,c], Richard G. Holroyd [a,b], Peggy Olsson [a,d]

[a] Cooperative Research Centre for Beef Genetic Technologies, Australia
[b] Dept Primary Industries & Fisheries, PO Box 6014, N. Rockhampton, Qld 4702, Australia
[c] Dept Primary Industries & Fisheries, Animal Research Institute, Locked Bag 4, Moorooka, Qld 4015, Australia
[d] Dept Primary Industries & Fisheries, Toorak Research Station, Julia Creek, Qld 4823, Australia

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ABSTRACT

This experiment assessed the effects of different quality and quantity of handling and quality of the holding yard environment on the productivity and physiological parameters indicative of stress in beef cattle. One-hundred-and-forty-four steers were given one of three human handling and yarding experiences on six occasions during a 12-month grazing period post-weaning (backgrounding): Good handling/yarding, Poor handling/yarding and Minimal handling/yarding. At the end of this phase the cattle were lot-fed for 78 days, with no handling/yarding treatments imposed, before being transported for commercial slaughter. Temperament was assessed by flight speed (FS) and a fear of humans (FOH) test, which measured the proximity to a stimulus person (ZA), the closest approach to the person (CA) and the amount the cattle moved around the test arena (TT). Mid-way through backgrounding, the Minimal treatment group was heavier than the Good, which was heavier than the Poor (mean weights 207, 201 and 194 kg, respectively; $P = 0.05$; LSD = 5.4), but by the end of backgrounding there was no difference between treatments and treatment did not affect liveweight during lot-feeding. At the end of backgrounding, plasma cortisol levels were significantly lower ($P < 0.001$) in the Good treatment group compared to the Poor and Minimal groups but at the end of lot-feeding there was no significant difference between the groups. Treatment affected plasma non-esterified fatty acid levels in backgrounding ($P = 0.060$) and lot-feeding ($P = 0.046$) with levels being higher in the Minimal than the Good and Poor groups (backgrounding: 0.52, 0.44 and 0.47 nmol/L, respectively; SE 0.02; lot-feeding: 0.46, 0.41 and 0.41 mmol/L, respectively; LSD = 0.05). Significant weak to moderate (r-value <0.50) negative correlations were found between FS and average daily gain, but there were no consistent correlations between measures from the FOH test and productivity. FS and TT were weakly positively correlated with plasma L-lactate, glucose and cortisol levels, and CA was weakly to moderately negatively correlated with L-lactate and glucose levels. The results indicate that, whilst being imposed, the Good treatment reduced stress and the Poor treatment negatively impacted on liveweight gain. Minimal handling/yarding appeared to cause the cattle to experience stress, perhaps because of the relative novelty of being handled and confined. This work also confirms previous findings that cattle with high FS have poorer liveweight gains under both pasture and feedlot conditions and FS has some value as a predictor of productivity.

* Corresponding author at: Dept Primary Industries & Fisheries, PO Box 6014, N. Rockhampton, Qld 4702, Australia. Tel.: +61 7 4936 0331; fax: +61 7 4936 1484.
E-mail address: carol.petherick@dpi.qld.gov.au (J.C. Petherick).

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Correlations also indicated that agitated cattle show a heightened arousal and stress responses when being handled. Fear of humans, as assessed by ZA, CA and TT, did not adversely affect productivity.

1. Introduction

Flight speed (the speed at which cattle exit from confinement), a measure of cattle temperament (Burrow et al., 1988), has been shown to be highly repeatable (Burrow, 1997; Petherick et al., 2002, 2003) and correlated with measures of productivity, such as liveweight gain and feed conversion efficiency in intensive finishing systems (Petherick et al., 2002, 2003). Previous studies indicate that flight speed is a trait that may be relatively difficult to modify (Petherick et al., 2002, 2003) and this together with its moderate heritability (Burrow and Corbet, 2000) has led us to suggest that flight speed largely reflects an innate aspect of an animal's character, possibly fearfulness (Petherick et al., 2002). As such, flight speed may be related to productivity measures because it determines how animals respond to unfamiliar situations and how well or badly animals cope with this novelty and other stressors, which involve physiological responses that affect metabolism (e.g. see Terlouw et al., 1997; Elasser et al., 2000).

If flight speed is indicative of the genetic component of cattle temperament or character, there will also be aspects that are developed experientially, which are likely to be subject to modification. One such aspect is an animal's response to humans, given that there is ample evidence that fear of humans changes with an animal's experiences (Boissy and Bouissou, 1988; Boivin et al., 1994; Hemsworth et al., 1996; Grandin, 1997; Jago et al., 1999)

We wished to further explore the different dimensions of cattle temperament, their malleability and whether certain aspects affect animals' abilities to cope with stressors and impact on productivity. To this end, we investigated the effects of different qualities of human handling and the holding yard environment imposed on young beef cattle when they were grazing and prior to lot-feeding. A companion paper reported on results pertaining to temperament assessment (Petherick et al., 2009) and this paper reports the consequences of the handling/yarding treatments and cattle temperament on productivity and indicators of stress.

2. Materials and methods

2.1. Backgrounding and lot-feeding

The management of the cattle is detailed by Petherick et al. (2009) but briefly, 144 stabilised 5/8 Brahman × 3/8 Shorthorn male, weaner calves were selected from 196, on the basis of liveweight, flight speed (FS) and measures from a fear of humans (FOH) test. The FOH test was conducted in a railed arena, the floor of which was marked to indicate 1-m zones from a person seated outside the arena. Measures from the FOH test were: the proximity to a stimulus person, zone average (ZA), which was where the animal was in the arena, on average, for a 3-min test $ZA = \left(\sum_{i=1}^{8} \text{zone}_i \times \text{time}_i\right)/180$ where zone_i is the ith zone and time_i is the total time spent in zone i; the closest approach to the person (CA); and the amount the cattle moved around the test arena (total transitions, TT). A blood sample was also collected from each animal. Forty-eight animals were allocated to each of three treatments: Minimal, where the cattle were separated from their group mates in yards and allowed to return to their home paddock; Good, where the cattle were given feed and water in the yards and were handled through the yards calmly and quietly, and with no physical contact from the handlers; and Poor, where the cattle were deprived of food and water in the yards, the handlers made as much noise as possible when handling the cattle, which were head-bailed and slapped and hit by the handlers. The aim of these treatments was to provide the cattle with minimal experience of being yarded and handled, a neutral or positive experience during handling/yarding and a negative experience during handling/yarding, respectively. The treatments were imposed every 2 months during a 12-month backgrounding period, during which the cattle grazed in a single group. At these same times, temperament was assessed by the measurement of FS, and liveweight and body condition score (BCS) were recorded. BCS was scored on a scale of 1–9, where 1 is emaciated and 9 is over-fat (Holroyd, 1985). Towards the end of backgrounding, temperament was again assessed by the FOH test and blood samples taken.

The cattle were then inducted into a feedlot, with the group divided into six pens balanced for treatment and liveweight, and were lot-fed for a period of 78 days. On day 41 of lot-feeding, the cattle were weighed and had FS recorded. Towards the end of the lot-feeding period (day 57), the cattle were again given another FOH test, had liveweight, BCS and FS recorded and a blood sample taken. A summary of the data collection dates is given in Table 1.

At the end of lot-feeding, the cattle were transported to an abattoir for commercial slaughter.

2.1.1. Blood sampling

On the first occasion (at allocation to the experiment), the cattle were blood sampled at varying times after the FOH test because they were handled as batches, i.e. individuals from a group were FOH tested and at the end of the FOH tests the animals were put through a race and blood sampled, but not necessarily in the same order as they were FOH tested. On the following two occasions, however, the cattle were kept in the order of FOH testing and blood sampled at a set time (about 25 min) from the conclusion of the FOH tests. All cattle were blood sampled via the coccygeal vein with restraint imposed by reducing the width of the crush; only in exceptional circumstances was an animal head-bailed for sampling.