EFFECTS OF TEMPERAMENT ON STRESS MECHANISMS IN BRAHMAN HEIFERS

K. O. Curley, Jr., D. A. Neuendorff, A. W. Lewis, J. J. Cleere, T. H. Welsh, Jr. and R. D. Randel

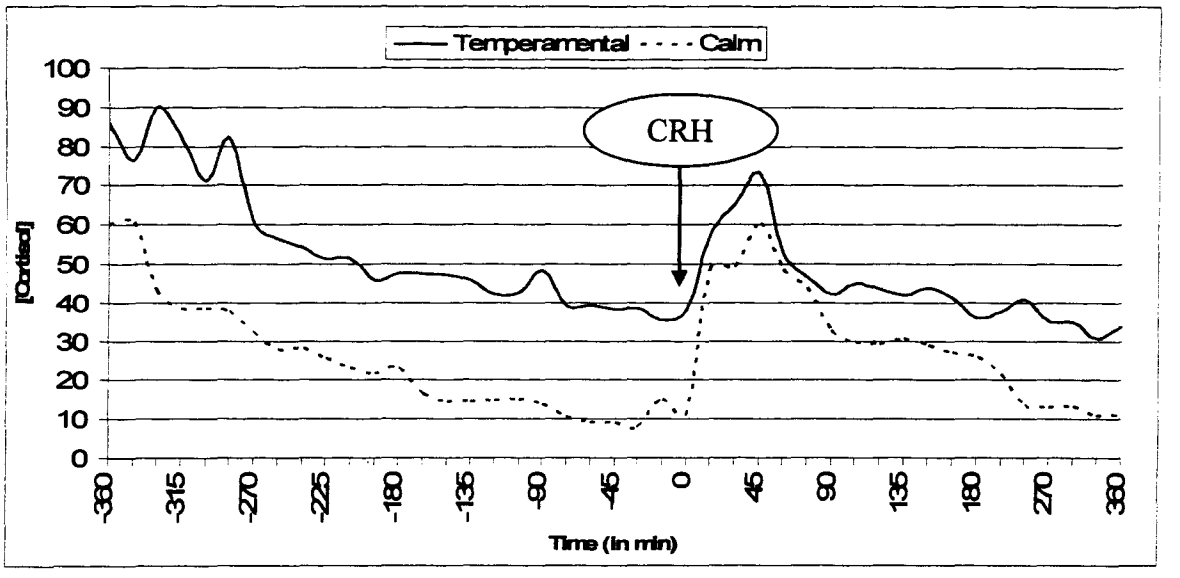
Background. Human-animal interactions, in livestock operations, occur due to requisite management practices. Temperament of cattle is commonly associated with a fear response to handling. Animal temperament has been associated with negative impacts in both dairy and beef production. Cattle with a poor temperament exhibit lower weight gains in the feedlot, bear a suppressed immune system, have inhibited milk production, and yield tougher meat, as well as increased amounts of both bruised trim and dark cutters. The biology associated with animal temperament is not fully understood. However, since fear has been shown to activate the hypothalamic-pituitary-adrenal axis (HPA), it is quite feasible that the degree of physiologic responses coupled to a typical stress response may vary due to animal temperament. The steroid hormone cortisol can serve as a measurable endpoint as it is released from the adrenal glands in response to neural recognition of stressors.

The objective of this study was to compare adrenal responsiveness, to challenge with exogenous corticotrophin-releasing hormone (CRH), in calm and temperamental heifers.

Research Findings. Twelve two-year old, spring-born Brahman heifers were utilized. Prior to the initiation of treatment, animal temperament was determined by measuring exit velocity; the six fastest (most temperamental) and six slowest animals (calmest) comprised the treatment groups. Exit velocity represents the rate (m/sec) at which an animal traverses a fixed distance (6 feet) upon exiting a squeeze chute. Each heifer was challenged with exogenous CRH (0.1 μg/kg of body weight) while the animals were confined within the chute. Challenges were administered, via indwelling jugular catheters (fitted 18h prior), following a 6h adjustment period and preceding a 6h response period. Blood sampling, also via catheters was conducted at15min. intervals with the exception of the first hour post-challenge, when sampling intervals decreased to 5min. Plasma cortisol concentrations were determined via radioimmunoassay.

Figure 1 represents the mean cortisol concentrations for the two temperament groups over the 12 h blood sampling period, with time 0 being the point of CRH administration. Throughout the sampling period, mean cortisol concentrations were higher in the temperamental heifers than in the calm ones.

Figure 1. Mean cortisol concentrations (ng/ml) for two temperament groups.



Pre-challenge measures such as basal cortisol concentration (means of samples -45 to 0) and area under the response curve (AUC) during the 6h pre-challenge period were significantly higher in the temperamental heifers.

Table 1. Exit Velocity and Pre-Challenge Measures (LS means ± s.e.)

Temperament Group	Exit Velocity (m/sec)	Basal [Cortisol] (ng/ml)	Pre-Challenge AUC (ng*min/ml)
Calm	1.05 ± .05 [a]	10.07 ± .73 [a]	8825 ± 452 [a]
Temperamental	3.14 ± .22 [b]	38.01 ± 2.98 [b]	19492 ± 967 [b]

[a,b] Means within columns with unlike superscripts differ (P<.01)

Peak cortisol concentrations were numerically higher in the temperamental group, while the response to CRH challenge (AUC from time 0 until return to basal) was lower. Following a return to basal, cortisol concentrations remained higher in the temperamental heifers.

Table 2. Post-Challenge Measures (LS means ± s.e.)

Temperament Group	Peak [Cortisol] (ng/ml)	Response AUC (ng*min/ml)	Post-Response AUC (ng*min/ml)
Calm	67.67 ± 1.74 [a]	5738 ± 406 [c]	9222 ± 644 [a]
Temperamental	78.99 ± 5.76 [a]	2737 ± 786 [d]	14973 ± 428 [b]

[a,b] Means within columns with unlike superscripts differ (P<.01) [c,d] Means differ (P=.08)

Application. As poor temperament relates to increased basal adrenal activity and muted responsiveness to pharmacological stimulus, temperament does affect HPA mechanisms. Improper function of this stress axis would not be desirable for producers. Exit velocity can be used as an indicator of temperament and thus to identify undesirable cattle within a herd.