Relationships between Carcass Quality and Temperament in Beef Cattle

Rhonda C. Vann, Brown Loam Branch Experiment Station, Mississippi State University, Raymond, MS

Economic implications associated with livestock temperament have not been fully determined (Grandin, 1994). Some producers do, in fact, consider temperament to be an important trait when selecting cattle for purchase (Elder et al., 1980). However, in some instances, genetic trait selection is often one-sided in the quest for improvement in a specific trait. Human-animal interactions in cattle production commonly occur through handling coupled with various management practices. Many concerns can arise, which include animal handler safety, damage to equipment and facilities, injury of the animal and etc. Cattle with wilder temperaments exhibit lower weight gain (Burrow et al., 1997; Voisinet et al., 1997b), produce tougher meat (Voisinet et al., 1997a), and yield increased amounts of bruise trim due to injuries acquired during transportation (Fordyce et al., 1988). Assessments of cattle temperament can be evaluated utilizing subjective measures (chute and pen scores) and an objective measure utilizing exit velocity. Establishment of a reliable and repeatable method to assess an animal's stress responsiveness is important for discerning cattle temperament. Producer and industry exposure to subjective and objective temperament assessments and recognition of the correlation between temperament with future growth performance, meat quality and health status is needed to encourage assessments of cattle temperament as a common selection tool.

The following studies were conducted utilizing three methodologies of temperament assessment, which included two subjective: chute (CS) and pen scores (PS) and one objective measure, exit velocity (EV). Chute scoring was adapted from Grandin (1993) where visual appraisal of each animal, while confined but not restrained in a working chute, were the basis of our scoring. Pen scores (Kunkle et al., 1986) were based on visual assessments of each animal while being confined to a pen with a small group of animals (n = 3 to 5 head). Exit velocity (Burrow et al., 1988) was determined as the rate at which the animals exited the working chute and transversed a fixed distance (1.83 m). Infrared sensors were used to remotely trigger the start and stop of a timing apparatus (Farm Tek Inc., North Wylie, TX).

The objectives of the following studies were to evaluate the effects of exit velocity (EV, m/s), chute temperament score (CS) and pen temperament score (PS) and measure the relationships between EV, CS and PS at weaning and prior to departure to the feedlot with carcass traits and Warner-Bratzler shear force values in Angus crossbred steers. Chute temperament scores are assigned as follows: 1 = calm, no movement; 2 = restless, shifting; 3 = squirming, occasional shaking of the squeeze chute or scale; 4 = continuous vigorous movement and shaking of the device; and 5 = continuous vigorous movement and shaking of the device, plus rearing, twisting or violently struggling (Voisinet et al., 1997a). Pen temperament scores were assigned as follows: 1 = non-aggressive, docile, walks slowly, can approach slowly, not excited by humans or facilities; 2 = slightly aggressive, runs along fences, will stand in corner if humans stay away, may pace fence; 3 = moderately aggressive, runs along fences, head up and will run if humans come closer, stops before hitting gates and fences, avoids humans; 4 = aggressive, runs away, stays in back of group, head high and very aware of humans, may run into fences and gates even with some distance, will likely run

into fences if alone in pen; 5 = very aggressive, excited runs into fences, runs over humans and anything else in path, "crazy".

Study 1: Angus crossbred steers (n = 58) were assigned a pen score, then calves were weighed on a platform scale and assigned a chute score. Calves were then released into a hydraulic squeeze chute and restrained. While in the squeeze chute a blood sample was collected from the tail vessel and then serum harvested for analysis of circulating cortisol concentrations. Exit velocity from the squeeze chute was measured by a laser timing device over a distance of 1.83 m from the chute (m/s). Assessments of temperament were performed at weaning (PS, CS and EV 1) and again prior to departure to the feedlot (PS, CS and EV 2). Steers were harvested at the completion of the feedlot feeding period and carcass data collected as well as steaks collected for analysis of shear force after a 14 day aging period. Sire consisted of one Brangus sire and several Angus sires. Lease square means were obtained from the PROC MIXED procedure of SAS (SAS Institute, Inc. Cary, NC) with main effects of sire breed, harvest date and age of dam. Partial correlation coefficients were obtained using the Manova option of the PROC GLM procedure of SAS (SAS Institute, Inc. Cary, NC) accounting for sire breed, calf breed, and harvest date. Sire breed was not a significant source of variation for EV, CS, PS or carcass traits of longissmus muscle area (LMA) and rib fat (BF); however, Brangus-sired steers had greater intramuscular fat (%IMF; $P < 0.06$) at weaning and greater carcass LMA per hundred weight (LMACWT; $P = 0.03$) and a higher USDA yield grade ($P < 0.05$). The correlation between EV and PS at T2 was 0.61 ($P < 0.001$). The correlation between EV and CS at T2 was 0.43 ($P < 0.008$). The correlation between PS at T1 and WBS as 0.24 ($P < 0.07$) and at T2 was 0.35 ($P < 0.08$). The regression coefficient between EV and WBS at T1 was 0.37 ($P < 0.04$) and at T2 was 0.57 ($P < 0.0095$) and PS and WBS at T1 were 0.39 ($P < 0.07$) and at T2 was 0.47 ($P < 0.008$). In conclusion, sire breed was not a significant source of variation in exit velocity. Although the correlation coefficients between exit velocity and temperament scores were significantly different from zero the magnitudes were only moderate, however, they were consistent across the various measures of temperament. As exit velocity (Table 1) and pen score increased WBS values also increased (Figure 1; Vann et al., 2004)).

Table 1. Means for Warner-Bratzler Shear force, exit velocity and Cortisol as reflected by pen score

Pen score 2	WBS (kg)*	EV (m/s)*	Cortisol (mg/ml)
1	2.38 ± 0.27	1.17 ± 0.37	23.19 ± 8.04
2	2.69 ± 0.15	2.08 ± 0.20	19.01 ± 4.42
3	2.97 ± 0.17	2.43 ± 0.22	27.67 ± 4.87
4	3.13 ± 0.27	3.85 ± 0.37	40.07 ± 8.04
	P = 0.07	P < 0.001	P = 0.05

*WBS=Warner-Bratzler shear force and EV = exit velocity.

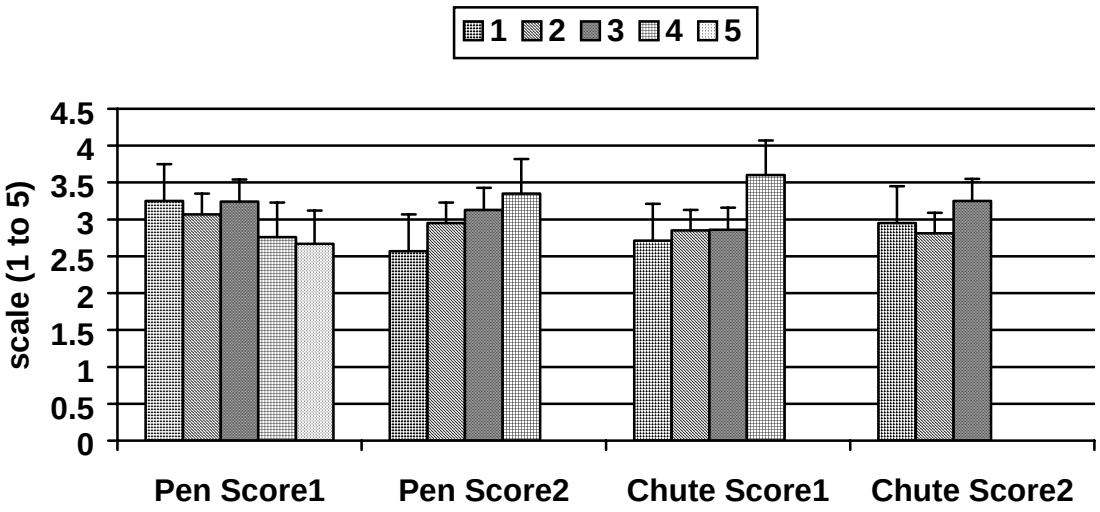

Figure 1. Warner-Bratzler shear force values for pen and chute scores at weaning and prior to shipment to the feedlot.

Three year data compilation: Angus crossbred steers (n = 220) were assigned a pen score, then calves were weighed on a platform scale and assigned a chute score. Calves were then released into a hydraulic squeeze chute and restrained. While in the squeeze chute a blood sample was collected from the tail vessel and then serum harvested for analysis of circulating cortisol concentrations. Exit velocity from the squeeze chute was measured by a laser timing device over a distance of 1.83 m from the chute (m/s). Assessments of temperament were performed at weaning (PS, CS and EV 1) and again prior to departure to the feedlot (PS, CS and EV 2). Steers were harvested at the completion of the feedlot feeding period and carcass data collected as well as steaks collected for analysis of shear force after a 14 day aging period. An overall temperament score, which is comprised of all measures of temperament, both subjective and objective was created [(EV+PS+CS)/3] and utilized in the statistical analysis. This compiled temperament score was divided into three categories: 1 = calm, 2 = intermediate, and 3 = temperamental or excitable. Sire breeds consisted of Brangus, Angus and Hereford. Least square means were obtained from the PROC MIXED procedure of SAS (SAS Institute, Inc. Cary, NC) with main effects of sire breed, individual sire, calf breed, and previous grazing regimen. Partial correlation coefficients were obtained using the Manova option of the PROC GLM procedure of SAS (SAS Institute, Inc. Cary, NC) accounting for sire breed, individual sire, calf breed, and previous grazing regimen. Individual sire influenced ($P < 0.04$) pen and chute score, exit velocity and cortisol concentrations at weaning, pen score ($P < 0.02$) and exit velocity ($P = 0.076$) prior to departure to the feedlot, yield grade ($P < 0.03$), carcass marbling score and quality grade ($P < 0.001$). Breed of sire influenced carcass weight and kidney, pelvic and heart fat ($P = 0.08$), and carcass rib fat and yield grade ($P < 0.03$). Breed of sire also influenced pen score at weaning and prior to departure to the feedlot ($P < 0.03$). The correlation between weaning temperament and shear force values were 0.23 ($P = 0.065$); pen and chute scores prior to shipment to the feedlot and shear force values were 0.22 ($P = 0.069$; Figure 2) and 0.23 ($P = 0.062$), respectively. As the compiled temperament score at weaning increased shear force values increased ($P =$

0.033; Figure 3). Pen scores at weaning were highly correlated with pen scores prior to shipment to the feedlot 0.45 (P = 0.0002); exit velocity at weaning was correlated with exit velocity prior to shipment to the feedlot 0.388 (P = 0.0015); chute scores at weaning were correlated with chute scores prior to shipment to the feedlot 0.311 (P = 0.012). Individual sires have direct effects on temperament scores of calves as assessed by the subjective and objective measures of temperament at weaning and prior to shipment to the feedlot. In addition, individual sire has direct effects on carcass quality as assessed by marbling score and quality grade and carcass yield grade. Measures of temperament whether subjective (pen and chute scores) or objective (exit velocity) are repeatable and moderately correlated at different management time points.

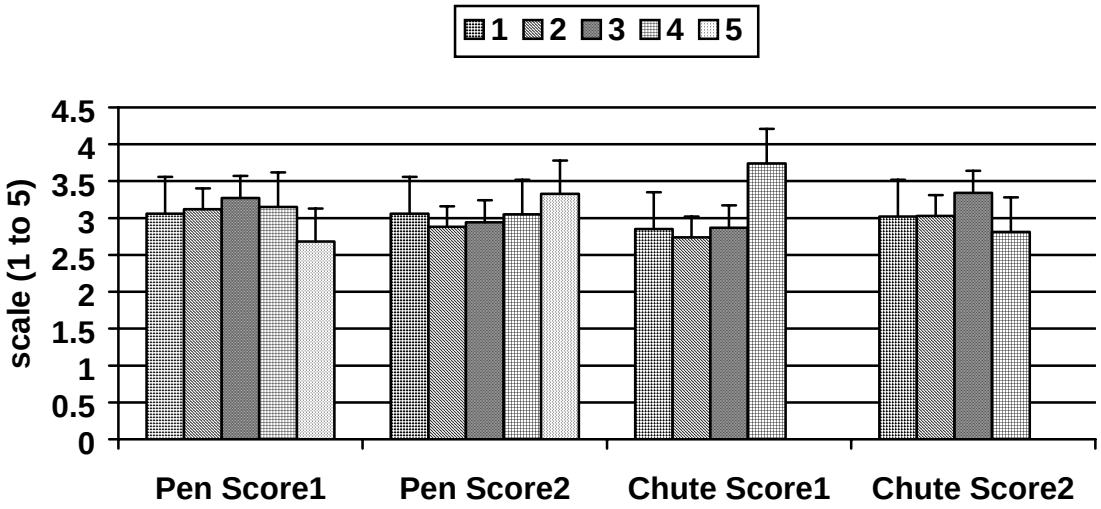

Figure 2. Warner-Bratzler shear force values for pen and chute scores at weaning and prior to shipment to the feedlot.

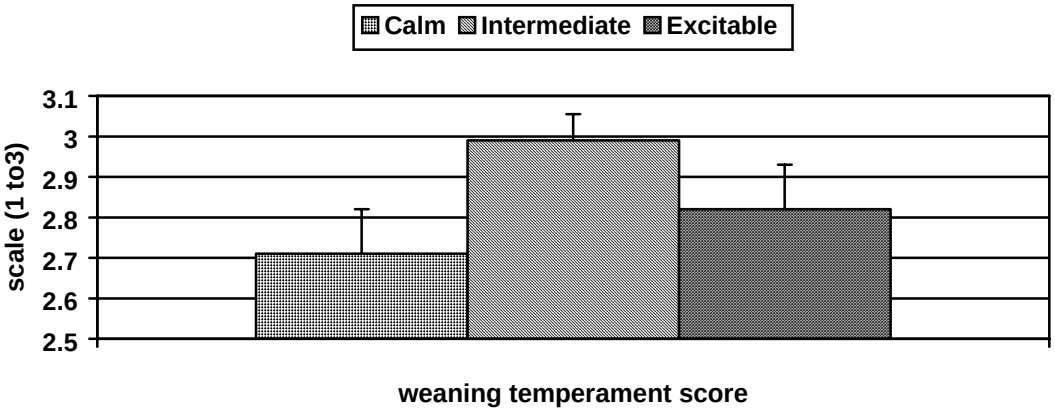

Figure 3. Warner-Bratzler shear force values for compiled weaning temperament score.

Individual sire did influence all measurements of temperament and carcass quality and yield grade. These studies as well as other data (not reported here) indicate that disposition needs to be a consideration along with the other selection traits when making bull or mature cow or replacement heifer purchases which bring new animals into your cattle operation. This research is ongoing and in the near future we will be including investigations on the effects of temperament on immunity and health status of the animal as well as effects on reproductive efficiency in beef cattle. Our hope is that producers and the cattle industry will utilize disposition in selection of animals, which will be more productive in their respective environments (i.e. choose which steers will perform better in a feedlot situation, choose replacement heifers, and etc.).

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