Working Chute Behavior of Feedlot Cattle Can Be an Indication of Cattle Temperament and Beef Carcass Composition and Quality

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Abstract

The influence of temperament on beef carcass quality traits was measured on 183 mixed-composition steer calves consigned to the Carrington Research Extension Center from the Central Dakota Feeder Calf Club at Turtle Lake, ND. Steers were blocked into four groups by weight and sorted into 16 different pens based on initial weight (606 lbs.). Steers were weighed individually every 28 days with data recorded for measuring temperament as exit velocity (EV), chute score (CS), catch score (CAPS), and chute vibration (VIB). Exit velocity was measured using entry/exit electronic timing apparatus set up 6 feet apart at the exit from the head gate. Chute score was a subjectively assigned number between 1 and 5 with 1 = calm and 5 = extremely aggressive. Similarly, catch score was assigned the same numerological/behavior score based on assessment of behavior while restrained in the head gate**.** Chute vibration was measured using a commercial electronic device magnetically attached to the scale. Tissue samples were collected with specially designed ear tags by Igenity® (Merial Ltd., Duluth, GA) for the commercial DNA profile including docility. Steers were harvested at 14 to 16 months of age (1335 lbs.). Measurements of hot carcass weight, ribeye area, 12th rib fat (**12FD**), percentage fat, kidney, pelvic, heart fat (**KPH**), intramuscular fat (**MARB**), and USDA yield grade (**YG**) were taken 24 hours (h) postmortem. Measurements for pH (45 min and 36 h after slaughter) and color scores (L*, a*, and b*) were taken (36 h after slaughter) on the ribeye at the designated times. Ribeye samples were collected and aged 14 days before Warner-Bratzler shear (**WBS**) force, a mechanical tenderness test. Exit velocity increased and CS and CAPS values declined over time indicating that animals acclimated to the working chute environment. First EV had significant ($P < 0.05$) correlations with WBS ($r = -0.19$) and last EV with YG ($r = 0.19$), 12FD ($r = 0.15$), KPH ($r = 0.19$), and MARB ($r = 0.15$). First CAPS significantly ($P < 0.05$) correlated with DRESS ($r = 0.16$), 36-hour pH ($r = 0.30$), and L* ($r = -0.20$), last CAPS with YG ($r = -0.17$), final BW ($r = -0.15$), and 36-hour pH ($r = 0.19$), and average CAPS with YG ($r = 0.17$), MARB ($r = -0.20$) and 36-hour pH ($r = 0.20$). Steers receiving a CAPS of 1 or 2 possessed more marbling (small degree of marbling) than steers with CAPS of 4 (slight degree of marbling). Ribeye steaks from steers with a slow first EV (> 1.0 sec) were more tender (WBS = 7.43 lbs.) than steaks from fast (< 0.70 sec) and moderate (0.71 to 0.99 sec) EV steers (8.60 and 8.42 lbs., respectively). However, steers with moderate to high genetic potential for docility (Igenity® docility index) had tougher WBS (8.64 and 9.44 lbs., respectively) than steers with low docility index (7.76 lbs.). These data indicate that behavior in the working chute environment may be an appropriate indicator of cattle carcass performance. It was interesting to note that cattle possessing a desirable genetic index for docility had tougher steaks. This conflicts with our data showing a linear relationship between EV and steak tenderness (slower EV had more tender meat). More research is necessary involving a larger sample size with a more diverse sampling of genetic docility.

Key words: beef, temperament, exit velocity

Introduction

What is the cost of production of feedlot cattle that possess an undesirable temperament? Feedlot managers and producers may attest to anecdotal evidence that more excitable cattle are more difficult to handle in the working chute, are later maturing, leaner, and have a lower propensity to quality grade USDA Choice or better. Assessment of beef cattle temperament has received greater interest in recent years due to the connection between *excitability*, animal physiology, carcass composition and quality, and a reduction in beef tenderness. Most of the research to date has assessed beef cattle temperament by recording the exit velocity of cattle as they are released from either the head gate restraint or scale. More excitable cattle exit at a higher velocity and are linked to producing (on average) tougher beef steaks. Subjective chute scores developed by Temple Grandin (a well-known animal behavior scientist) have also been recorded for cattle activity in the working chute whereby a score of 1 = calm, 2 = slightly restless, 3 = squirming and occasionally shaking the chute, 4 = continuous vigorous movement and shaking of the chute, and 5 = rearing and twisting of the body and struggling violently.

Certainly these evaluation criteria are indicative of perceived cattle activity that every beef producer is familiar with and may even trigger memories of specific cattle that invoked a feeling of satisfaction when watching the offending individual loading on the trailer destined for the slaughter house. They are familiar, but can the temperament of cattle be used as an indicator of carcass palatability? Is the *temperament* of an animal imbedded in its genetic makeup?

The objectives of this study were to 1) evaluate the relationship between quantitative measurements of beef cattle excitability (exit velocity, chute score, and catch score) and carcass composition and quality; 2) assess the relationship between measures of cattle excitability and the genetic potential (Igenity® index) for docility and economically valuable carcass traits.

Materials and Methods

Animals. All procedures involving animals were reviewed and approved by the North Dakota State University Institutional Animal Care and Use Committee. One hundred eighty-three steers of mixed composition *Bos taurus* (5 to 8 months of age) were consigned to the Carrington Research Extension Center from the Central Dakota Feeder Calf Club at Turtle Lake, ND. Upon entry into the feedlot, steers were blocked into four weight groups and sorted into 16 pens based on initial weight (606 lbs.) and fed a standard industry finishing diet. Steers were weighed individually every 28 days to monitor growth, health status, and as a means to calculate average daily gain.

At each weigh period, data was recorded for animal disposition as exit velocity (**EV**), chute score (**CS**), catch score (**CAPS**), and chute vibration (**VIB**). Exit velocity, as described by Burrow, Seifert, and Corbet (1988), was measured by infrared motion sensors (FarmTek, Inc., Wylie, TX; Figure 1). The “start” sensor was placed approximately two feet from the end of the working chute (head gate) and the “finish” sensor was set 6 feet away. Exit velocity was recorded as the time it took each steer to run 6 feet from the exit of the working chute. Faster times are thought to be indicative of more excitable cattle. Chute score was visually observed and scored while animals were on the weigh scale when both entry and exit doors were closed. The CS were developed by Grandin (1993) whereby a score of 1 = calm, no movement; 2 = slightly restless; 3 = squirming, occasionally shaking the chute; 4 = continuous, very vigorous movement and shaking of the chute; 5 = rearing, twisting of the body and struggling violently. Animals on the weigh scale were not under any restraint in the enclosed area of the scale. The CAPS was recorded in accordance with the same numeric scale (1 to 5) used to assess the chute score, however, this assessment took place while the steers were captured in the head gate. Working chute VIB was collected by a device (SAVER 3x90; Lansmont Corporation, Monterey, CA) that recorded vibrations and other motions (root mean square acceleration, change in velocity, acceleration). The SAVER was magnetically affixed to the scale and recorded the level of vibrations (activity) in the chute while the steer was present. The intent of obtaining these data was to provide an objective measurement to validate the subjective CS and CAPS.

A

B

Figure 1A) Exit velocity setup. The "start" sensors were placed three feet from the head gate and the 'finish" sensors set 6 feet away. B) Exit velocity was recorded as the time for the steer to run 6 feet from the exit of the working chute.

Tissue samples were collected for commercial DNA profile testing as conducted through Igenity®. Igenity® profiles were obtained for the following genetic traits: tenderness, ribeye area, fat thickness, marbling, percent choice, hot carcass weight, yield grade, heifer pregnancy rate, maternal calving ease, stayability, PI-BVD, coat color, and docility. The profile provided back from Igenity® is presented as a numeric index from 1 (lowest potential for genetic improvement of a given trait) to a 10 (highest genetic potential).

Carcass Data. One hundred eighty steers were delivered to Tyson Inc. (Dakota City, NE) for humane harvest at 14 to 16 months of age (avg. BW = 1,335 lbs.). Measurements of hot carcass weight, ribeye area, 12th rib fat (**12FD**), percentage fat, kidney, pelvic, heart fat (**KPH**), intramuscular fat (**MARB**), and USDA yield grade (**YG**) were taken 24 hours postmortem. Also at 24 hours postmortem, a two-rib section was obtained from adjacent the 12^{th} rib (10 – 12^{th} rib section), placed in Ziploc storage bags and placed in a cooler for transport back to the NDSU Meats Lab. Longissimus (ribeye) muscle pH was also recorded at the packing plant at 45 minutes postmortem.

Ribeye samples were unpackaged and deboned at the NDSU Meats Lab approximately 36 hours postmortem. A one-inch thick boneless ribeye steak was cut from the two-rib section for use in Warner-Bratzler shear (**WBS**) force (mechanical indication of tenderness) measurement.

Intramuscular pH was once again recorded and color scores were obtained using a Minolta chroma-meter to record L* (lightness/ darkness), a* (redness), and b* (yellowness) of each ribeye steak. Each steak was then weighed, tagged for identification, vacuum packaged, and aged for 14 days. After 14 days, steaks were removed, weighed and prepared for WBS determination (AMSA, 1995). Steaks were cooked on a clamshell type grill (George Forman Lean Mean Fat-reducing Grilling Machine™) to a final temperature of 160ºF. After reaching their endpoint temperatures, cooked steaks were placed on a tray, covered with tin foil to reduce moisture loss, and cooled to room temperature. After cooling, six, ½ inch diameter cores were excised from each steak parallel to the muscle fiber, and sheared perpendicular to the fiber orientation on the WBS shear instrument (G. R. Electric, Manhattan, KS).

Statistical analysis. Pearson correlation coefficients were calculated using the PROC CORR procedure of SAS (SAS Institute Inc., Cary, NC) for feedlot ADG (lbs. per day), beef carcass composition and quality variables, WBS, EV, CS, VIB and CAPS to determine the relationship between individual steer disposition in the working chute and beef parameters of economic importance. Since multiple disposition readings (EV, CS, VIB and CAPS) were obtained over the entire feeding period, those readings with the highest correlation to beef parameters of economic importance (i.e. marbling or tenderness; WBS) were identified for further analysis. Each steer was assigned to a fast (< 0.7 sec), medium (0.71 to 0.99 sec), and slow (> 1.0 sec) EV category. Least Squares Means separation using the General Linear Model of SAS was used to determine statistical differences ($P < 0.05$) between the fixed effects of slow, medium, and fast EV for ADG and carcass composition and quality measurements. Likewise, each steer was classified as possessing low, medium, and high genetic potential for docility and tenderness based on Igenity® index values. Steers classified as low genetic potential for docility or tenderness had an index of 1, 2, or 3; medium had scores of 4, 5, and 6; and high scored 7, 8, 9, and 10. Least Squares Means separation using the General Linear Model of SAS was used to determine statistical differences ($P < 0.05$) between the fixed effects of genetic potential classification (low, medium, and high) for WBS and marbling score.

Results and Discussions

Means, standard deviation, minimum, and maximum measurements recorded for feedlot steers' ADG and carcass parameters are presented in Table 1. Steers averaged 3.56 lbs. per day over the 188 days on feed and finished with an average live weight of 1,335 lbs. Carcasses (avg. wt. 814 lbs.) possessed an average USDA quality grade of low choice, yield grade of 2.74, with an average ribeye area of 13.7 in^2. Average WBS classified as slightly tender (8.33 lbs. of shear force). According to Shackelford et al. (1991), 10 lbs. of WBS was the threshold trained sensory panelists ceased to classify beef top loin steaks as "slightly tender". The range of WBS force spanned tender to tough in the current data set (4.56 to 21.30 lbs. of shear force, respectively).

Table 1. Means, standard deviation, minimum and maximum values for average daily gain and carcass parameters.

Variable	N	Mean	Standard Deviation	Minimum	Maximum
Avg. Daily Gain, lbs./d	181	3.56	0.41	2.19	4.42
Final USDA Yield Grade	181	2.74	0.80	1.00	5.50
Final Live Body Weight	181	1335.00	113.26	1074.00	1710.00
Hot Carcass Weight	181	824.00	78.44	639.00	1079.00
Dressing Percent	181	61.70	2.00	51.10	67.90
12th rib Fat Thickness, inches	180	0.42	0.17	0.03	0.98
Ribeye Area, $inches^2$	180	13.70	1.48	9.47	18.12
Kidney, Pelvic, & Heart Fat, %	181	2.04	0.61	0.00	3.50
Marbling Score[1]	181	303.10	78.22	147.00	514.00
Warner-Bratzler Shear Force, lbs.	180	8.33	2.23	4.56	21.30
45-minute ribeye pH	179	6.82	0.19	6.23	7.40
36-hour ribeye pH	180	5.49	0.09	5.37	6.55
L* value (lightness)	180	40.70	2.20	33.70	50.42
a* value (redness)	180	23.36	1.53	16.50	27.86
b* value (yellowness)	180	9.59	1.22	4.47	15.10

[1]Marbling Score numeric designation: 100 = traces; 200 = slight; 300 = small; 400 = modest; 500 = moderate.

Objective VIB recordings obtained by the SAVER 3x90 did not correlate (nonsignificant) to any economically important carcass traits and will not be discussed in this paper. Table 2 contains data collected for EV, CS, and CAPS for each weigh date. Exit velocity increased (cattle exited slower) and CAPS declined over time indicating that the steers became more acclimated to the working chute environment with each visit. The improvement in disposition over time is an indication that cattle management was appropriate and the animal handlers did not create a stressful situation that would agitate the steers upon repeated visits to the working chute. Chute scores recorded for cattle while enclosed in the chute for weighing are less clear cut showing the highest readings (most agitated) occurring in the first and last visit with the lowest scores observed in February. The February weigh date was the coldest day the cattle were worked with temperatures well below 0°F. It is likely that the cold weather dampened the cattle's spirit; it certainly slowed the human handlers. None-the-less, CS averaging less than 2 (Table 2) indicated that the cattle, on average, were only "slightly restless" while in the weigh scale suggesting the overall disposition of this group was calm.

Table 2. Least squares means and level of significance for working chute exit velocity, weigh scale chute score, and head gate catch score for each designated weigh date.

	Oct. 23, 2007	Nov. 20, 2007	Dec. 18, 2007	Jan. 15, 2008	Feb.12, 2008	Mar. 11, 2008	Apr. 08, 2008	Apr. 28, 2008	Overall Average
Exit Velocity (seconds)	0.792^{a}	0.701^{a}	0.748^{a}	0.771^{a}	1.130^{b}	1.282^{c}	–	1.322^{c}	0.95
Chute Score[1] (1 to 5)	2.10^{d}	1.97^{cd}	1.70^{b}	–	1.37^{a}	–	1.85^{bc}	2.04^{d}	1.84
Catch Score[1] (1 to 5)	–	2.68^{b}	–	2.53^{b}	–	1.97^{a}		–	2.39

$^{a, b, c, d}$Means with different superscripts within rows were different ($P < 0.05$)

[1]Numeric designation for chute and catch score: 1 = calm, no movement; 2 = slightly restless; 3 = squirming, occasionally shaking the chute; 4 = continuous, very vigorous movement and shaking of the chute; 5 = rearing, twisting of the body and struggling violently (Grandin, 1993)

Analysis utilizing Pearson's correlation coefficients provides insight relative to which measures of animal disposition correlate to or influence carcass parameters of economic importance. For example, the last EV (Apr. 28, 2008) recorded the day prior to cattle transport to market, had a significant ($P = 0.011$) positive correlation with USDA yield grade (Table 3). This indicates that as EV increased (cattle were slower), final yield grade increased. It is important to remember that a higher USDA yield grade is indicative of a lower yield of boneless, closely trimmed retail cuts; fatter, less muscular carcasses. Nkrumah et al. (2007) reported an opposite affect showing a negative correlation ($r = – 0.25$) between EV and YG indicating that slower exiting cattle had lower USDA yield grades. Both Nkrumah et al. (2007) and Voisinet et al. (1997a) found that feedlot cattle possessing an excitable temperament and more rapid EV had lower ADG. The reduction in ADG in these studies could have played a factor in the lower USDA yield grade exhibited by the faster EV cattle. We saw no statistically significant relationship between any measure of animal temperament (EV, CS, or CAPS) and feedlot ADG (Table 3).

Table 3. Correlation Coefficients (level of significance) for selected carcass composition parameters.

Variable[1]	FYG	ADG	LWT	HCWT	Dress	12thFT	REA	KPH
	-0.0516	0.0367	0.091	0.068	-0.051	-0.0479	0.0731	0.0818
FirstEV	-0.495	-0.628	-0.225	-0.367	-0.504	-0.528	-0.335	-0.279
	0.1938	0.0617	0.0974	0.0711	-0.0465	**0.1495**	-0.0799	**0.1919**
LastEV	-0.011	-0.421	-0.204	-0.354	-0.545	-0.051	-0.299	-0.012
	0.1231	0.0188	0.1042	0.0833	-0.0332	0.0608	-0.0429	**0.1853**
AvgEV	-0.099	-0.801	-0.163	-0.265	-0.658	-0.418	-0.567	-0.012
	-0.0478	0.0814	0.016	0.0225	0.0316	0.0237	0.107	**0.1663**
FirstCS	0.524)	-0.277	-0.831	-0.765	-0.674	-0.753	-0.154	-0.026
	-0.1241	-0.0526	-0.0929	0.086	-0.0015	-0.0957	0.0702	0.0142
LastCS	-0.097	-0.483	-0.215	-0.251	-0.984	-0.203	-0.35	-0.85
	-0.0249	0.0674	0.0112	0.0064	-0.0064	0.0009	0.0645	0.1236
AvgCS	-0.74	-0.368	-0.881	-0.932	-0.932	-0.99	-0.389	-0.097
	0.0864	-0.0573	-0.0847	-0.1264	**-0.1604**	-0.0306	0.0136	-0.1191
FirstCAPS	-0.247	-0.444	-0.257	-0.09	-0.031	-0.684	-0.856	-0.11
	-0.166	-0.0765	**-0.1452**	-0.1315	-0.0134	-0.099	0.0808	-0.1052
LastCAPS	-0.026	-0.306	-0.051	-0.078	-0.858	-0.186	-0.281	-0.159
	-0.1689	-0.059	-0.074	-0.0906	-0.0815	-0.0903	0.114	-0.1163
AvgCAPS	-0.025	-0.437	-0.329	-0.232	-0.282	-0.235	-0.132	-0.124

[1]FirstEV = first recorded exit velocity; LastEV = last recorded exit velocity; AvgEV = average of all exit velocity measurements; FirstCS = first recorded chute score; LastCS = last recorded chute score; AvgCS = average of all chute scores; FirstCAPS = first recorded catch score; LastCAPS = last recorded catch score; AvgCAPS = average of all catch scores; FYG = final USDA yield grade; ADG = average daily gain; LWT = final live body weight; HCWT = hot carcass weight; Dress = HCWT/ LWT * 100; 12thFT = external fat thickness recorded adjacent the 12th/ 13th rib interface; REA = ribeye area; KPH = kidney, pelvic and heart fat expressed as a percentage of hot carcass weight.

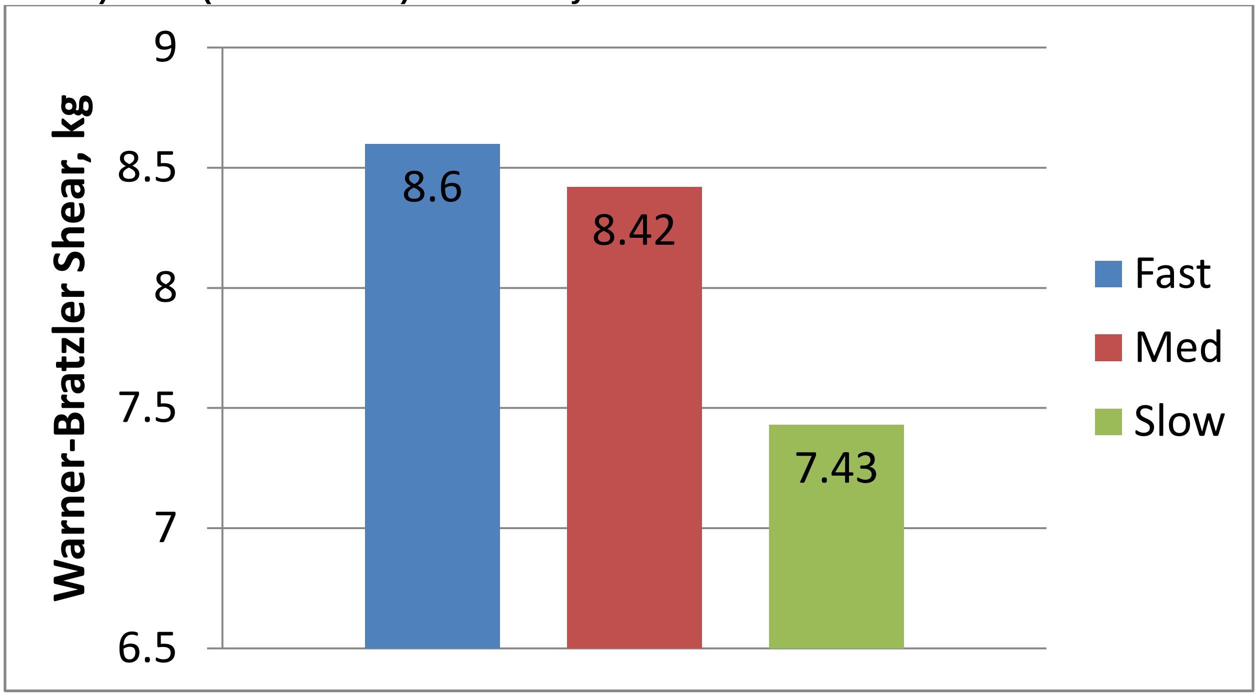
Most of the research to date has assessed beef cattle temperament by recording the exit velocity of cattle as they were released from either the head gate restraint or scale. More excitable cattle exit at a higher velocity and are linked to producing (on average) tougher beef steaks (Voisinet et al., 1997b). In our study, the first recorded EV (Oct. 23, 2007) possessed a significant (P = 0.008) negative correlation (– 0.1992) with WBS (Table 4). This indicates that as EV times decreased (faster exiting animals), WBS force values increased (steaks were more tough). Figure 2 illustrates this relationship graphically showing that slow EV calves possessed a significantly lower WBS than their medium and fast counterparts. This could be an indication that cattle with a more heightened “fight or flight” instinct may generate stronger contracting muscle fibers that could possess more mature collagen fibers that could result in tougher beef steak.

Table 4. Correlation Coefficients (level of significance) for selected carcass quality parameters.

Variable[1]	Marb	WBS	pH45	pH36 h	L*	a*	b*
	0.1282	**-0.1992**	0.1379	-0.1133	0.0554	0.0276	0.0385
FirstEV	-0.089	-0.008	-0.069	-0.134	-0.465	-0.716	-0.612
	0.1466	-0.0763	-0.0226	-0.1449	0.1079	0.1347	**0.1621**
LastEV	-0.054	-0.32	-0.769	-0.058	-0.159	-0.078	-0.034
	0.1107	**-0.145**	0.0703	**-0.1709**	0.0806	0.1071	0.1315
AvgEV	-0.138	-0.052	-0.35	-0.022	-0.282	-0.152	-0.078
	-0.1292	0.1046	-0.0177	0.0311	-0.0488	0.0802	0.0763
FirstCS	-0.084	-0.164	-0.815	-0.679	-0.516	-0.286	-0.31
	-0.1324	0.0577	-0.066	-0.0775	-0.0331	0.0259	0.0128
LastCS	-0.076	-0.442	-0.38	-0.301	-0.659	-0.7297	-0.865
	-0.1043	0.1082	-0.0411	0.0621	-0.0964	0.0151	0.0037
AvgCS	-0.162	-0.148	-0.585	-0.407	-0.198	-0.841	-0.961
	-0.1078	0.0003	0.1066	**0.3032**	**-0.1957**	**-0.1509**	**-0.1672**
FirstCAP	-0.149	-0.997	-0.156	(< 0.001)	-0.009	-0.043	-0.025
	-0.1327	0.1102	0.0377	**0.1916**	-0.0853	-0.1119	-0.1158
LastCAP	-0.075	-0.141	-0.616	-0.01	-0.255	-0.135	-0.122
	-0.1959	0.1061	0.0707	**0.2033**	-0.1359	**-0.1447**	**-0.1485**
AvgCAP	-0.009	-0.162	-0.354	-0.007	-0.073	-0.056	-0.05

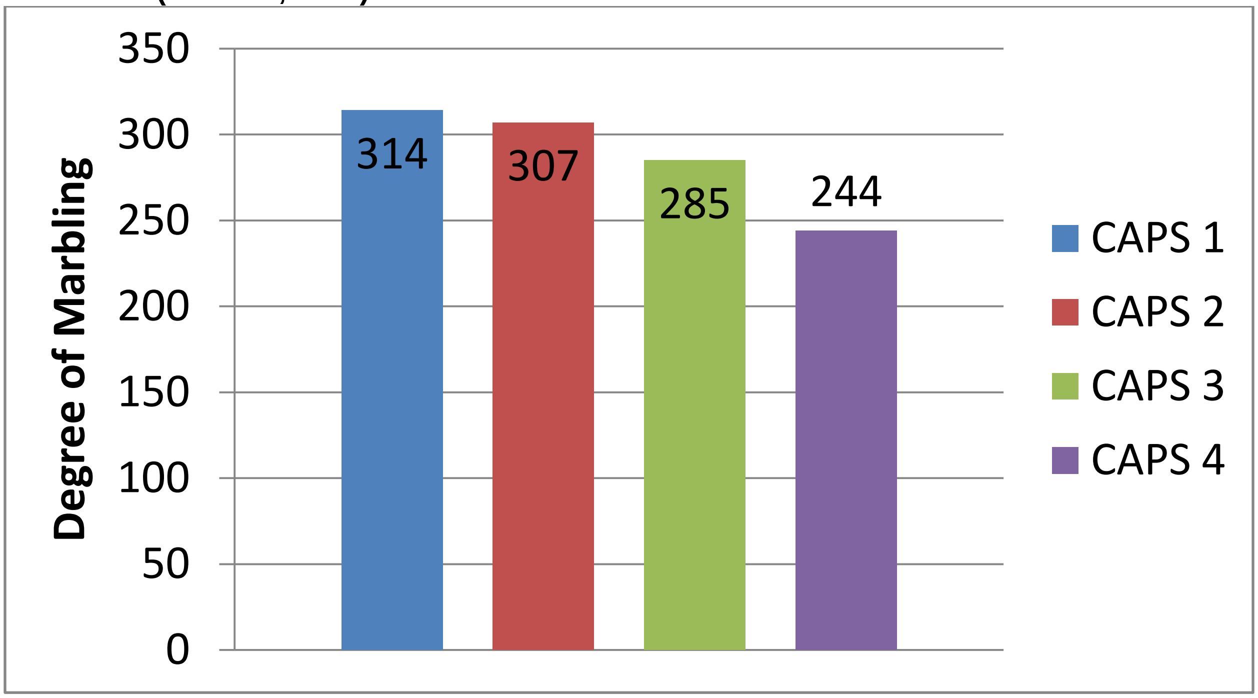
[1]FirstEV = first recorded exit velocity; LastEV = last recorded exit velocity; AvgEV = average of all exit velocity measurements; FirstCS = first recorded chute score; LastCS = last recorded chute score; AvgCS = average of all chute scores; FirstCAPS = first recorded catch score; LastCAPS = last recorded catch score; AvgCAPS = average of all catch scores; Marb = marbling score; WBS = Warner-Bratzler Shear force (mechanical tenderness); pH45 = intramuscular pH obtained between the 12th/ 13 rib in the ribeye muscle at 45 minutes postmortem; pH36h = intramuscular pH obtained in the ribeye steak at approximately 36 hours postmortem; L* = electronic color measurement indicating lightness/ darkness whereby 100 is pure white and 0 is pure black; a* = electronic color measurement indicating level of redness whereby a positive value is in the red color spectrum and a negative value is in the green color spectrum; b* = electronic color measurement indicating level of yellowness whereby a positive value is in the yellow color spectrum and a negative value is in the blue color spectrum.

Figure 2. Warner-Bratzler shear force values across fast (≤ 0.7 sec), medium, and slow (≥ 1.0 sec) initial (first recorded) exit velocity.



Voisinet et al. (1997b) also indicated that feedlot cattle with a more excitable temperament were more prone to develop dark cutting beef. While none of the cattle in our study were classified as “dark cutters” by the USDA grader, there was a significant positive correlation between the last recorded CAPS and 36-hour (postmortem) pH (r = 0.1916) indicating that steers that were more excitable while restrained in the head gate had a higher muscle pH (Table 4). The higher muscle pH is an indication that these calves had more metabolic activity within the muscle prior to slaughter. An elevated muscle pH is an indication of dark cutting beef. Furthermore, the first recorded CAPS had a negative (r = – 0.1957) correlation with L* value, which indicates that a higher CAPS was related to a lower lightness value (darker colored lean). It is also important to note that average CAPS had a strong negative correlation (r = – 0.1959) with marbling score. This indicates that steers that became more excitable as a result of head gate capture ultimately possessed less intramuscular fat and were at risk of a lower USDA quality grade (Figure 3).

Figure 3. Marbling scores across catch score (CAPS); whereby 1 = calm; 2 = slightly restless; 3 = squirming, occasionally shaking the chute; 4 = continuous, very vigorous movement (Grandin, 1993).



The research of others, as well as our own, indicates that feedlot cattle possessing a more excitable temperament have the potential to generate meat with negative palatability aspects. Most beef cattle producers have undoubtedly observed that cows or bulls possessing an undesirable temperament also produce calves with an undesirable temperament. Based on that observation, Igenity®, a subsidiary of Merial Limited (Duluth, GA), developed a genetic marker for bovine docility (as well as other markers for tenderness, carcass traits, and reproduction). Figure 4 shows that the steers from our study that possessed the highest Igenity® index for beef tenderness were significantly more tender than their low indexing contemporaries. What is interesting in our study is the relationship between the genetic potential for docility and tough meat. Igenity® docility index had a significant (P = 0.001) positive correlation (r = 0.2363) with WBS indicating that a higher (more positive) index was associated with a higher (tougher) WBS force. You will recall in Figure 2, that slower EV cattle had more tender steaks indicating that cattle with a more mild temperament are more prone to have more tender beef. However, Figure 5 displays that the steers in this experiment possessing a higher Igenity® index for docility had tougher steaks (higher WBS) than the low indexing steers. Moreover, no significant relationship with Igenity® docility index and EV, CS or CAPS was observed in our study. The absence of a relationship between genetic potential for docility and our recordings of temperament could be due to the limited number of high and low indexing cattle in our trial (Table 5).

Figure 4. Warner-Bratzler shear force values across low (≤ 3), medium, and high (≥ 7) genetic potential for Igenity® tenderness index.

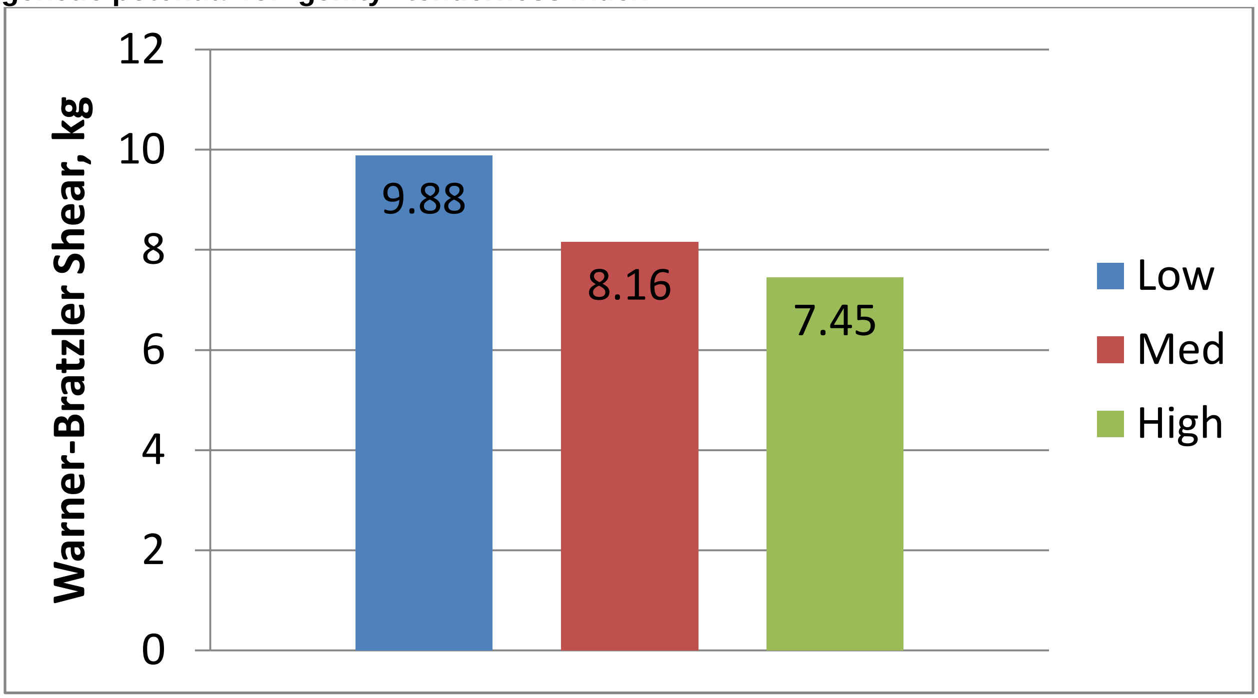


Figure 5. Warner-Bratzler shear force values across low (≤ 3), medium, and high (≥ 7) genetic potential for Igenity® docility index.

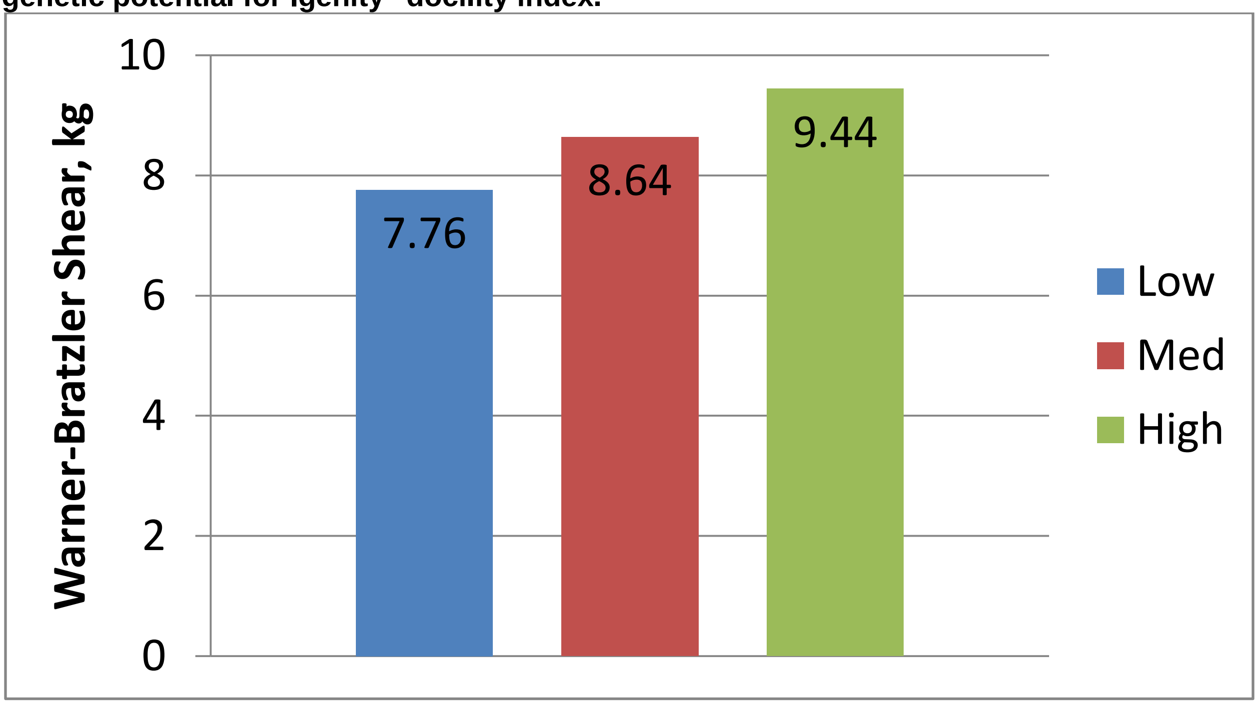


Table 5. Number of cattle in each Igenity® index score across the genetic trait classification categories of docility, tenderness, marbling, carcass yield grade, ability to grade choice or higher, and ribeye area.

	Index 1	Index 2	Index 3	Index 4	Index 5	Index 6	Index 7	Index 8	Index 9	Index 10
Docility	1	16	52	37	44	22	2	6	1	0
Tenderness	6	0	34	51	16	31	28	4	5	3
Marbling	0	0	2	6	25	36	47	45	17	3
USDA Yield Grade	0	0	4	16	42	54	42	24	0	0
% USDA Choice	0	0	4	13	36	46	44	29	9	0
Ribeye area	0	1	18	44	51	44	19	4	1	0

Implications

This research confirms what others have noted with regard to exit velocity and tough beef. Our study is unique in its evaluation of catch score of animal temperament when captured in the head restraint. The observation that steers who more aggressively fight head restraint possess less marbling and a lower capacity to grade USDA choice or higher is an economically important finding. Also, our use of Igenity® index to compare genetically similar carcass traits is unique. Our observation that steers possessing medium to high genetic potential for docility had tougher steaks has not been reported by other researchers. Further research by our group will evaluate the activity of muscle proteases that are associated with beef tenderness in an effort to further understand the relationship between animal disposition and beef toughness. Also, it is likely that the steers used in this study did not possess substantial genetic diversity with regard to docility. More research is necessary to discover the underlying physiological reasons for excitable cattle to generate negative palatability attributes.

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