The relationship between beef quality and carcass quality attributes measured under commercial conditions

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Introduction Objective measures of beef carcass quality appear to resolve some of the issues surrounding the subjective aspect of beef carcass classification (Allen and Finnerty 2000). Carcass conformation is important to the producer and processor whereas meat colour and tenderness are important to the consumer. Yet eating quality is not part of the current grading system. In this study, the relationships between carcass yield traits in commercial cattle and objective measures of meat quality were analysed considering both VIA predicted and recorded weights of primals. The aim was to establish whether both carcass yield and meat quality goals can be achieved in a value-based marketing system that rewards producers on both meat yield and meat quality parameters.

Materials and methods Animals were selected based on breed and sex in an abattoir where a commercial VIA machine (E+V GmbH, Oranienburg, Germany) was operating on-line. On the Monday of each week, eight Charolais-cross, eight Limousin-cross and eight Dairy-cross animals were selected for the study. For each breed group, four steers and four heifers were selected per week except for the dairy cross group where young bulls were substituted for heifers. Over 10 weeks, six classes of animals and samples were obtained in 10 batches for the VIA predicted traits, while actual recorded primal weights were recorded on the first six batches only. Age at slaughter, together with VIA based grades (based on the 15 point scales), weights and yield estimations for weight from the right hand half carcass were recorded. Quartering was at the $9^{th}/10^{th}$ rib, where a section of the longissimus muscle was recovered for pH (Testo 205) and colour analysis on site allowing a 45min blooming period (Minolta CR-410, D65 illumination, 2° standard observer with a 50 mm aperture). Carcasses were subject to electrical stimulation (90V for 30 sec 10 minutes PM). Complete sirloins were removed intact from the hind quarter (Pistola) at 48hrs PM and commercially processed into the marketable striploin and tenderloin with each measured trait being weighed (Table 1). Longissimus steaks were cooked to an internal temperature of 71°C and slice shear force (SSF) was measured three days PM as outlined by Shackelford *et al.,* (1999). A logarithmic transformation (base 10) was applied to SSF measurements for the analysis. Partial correlations between meat quality and VIA-predicted yields and recorded primal weights were obtained using the GLM procedure of SAS (SAS Inst. Inc., Cary, NC) including batch, and combined breed-sex classes as fixed effects with age as a co-variable.

Results Basic statistics and partial correlations are given in table one. A small but significant negative correlation observed between SSF and VIA predicted striploin weight (-0.18), VIA conformation (-0.21) and measured tenderloin weight (-0.18) were favourable because a lower SSF value indicates greater tenderness ($P<0.05$). Young bulls were significantly less tender than steers ($P<0.001$) or heifers ($P<0.05$), but no significant differences in tenderness were observed among breeds. Small but significant negative correlations were estimated between pH (48 hr) & VIA pistola weight (-0.18) and measured striploin weights. But there were no significant differences in pH between sexes or breeds. Positive correlations were shown between Lightness (L*), redness (a*) and yellowness (b*) and measured sirloin weights. No differences in colour traits were observed between the sexes, but Charolais sirloin steak was lighter and more yellow ($P<0.001$) than Limousin and redder (a*) than Dairy ($P<0.05$). A stronger and more significant positive correlation was obtained between L* and VIA fat class (0.28, $P<0.01$) compared to L* and measured fat trim (0.19 $P<0.05$).

Table 1 Basic statistics for predicted and measured traits also showing partial correlations between pH, colour and tenderness measures and carcass quality traits *P*<0.05* *P*<0.01** *P*<0.001***

VIA predicted:	n	mean	CV%	pH (48h)	L*	a*	b*	SSF
Forequarter weight (kg)	196	63.24	17.4	-0.150	0.144	0.284[3]	0.308**	-0.105
Striploin weight (kg)	196	7.22	20.0	-0.139	0.149	0.344[3]	0.323***	-0.181*
Pistola weight (kg)	196	104.52	17.9	-0.177*	0.146	0.298[3]	0.318***	-0.109
Conformation (15pt)	196	6.78	31.1	0.014	0.086	0.232[3]	0.152	-0.211*
Fat class (15pt)	196	10.31	22.0	-0.172	0.283**	0.187[3]	0.280**	-0.044
Measured trait (kg):	n	mean	CV%	pH (48h)	L*	a*	b*	SSF
Complete weight	140	15.29	15.5	-0.198*	0.202*	0.343[3]	0.377***	-0.091
Boned striploin weight	140	8.32	18.6	-0.198*	0.233**	0.357[3]	0.407***	-0.055
Trimmed striploin weight	141	7.22	18.8	-0.212*	0.197*	0.351[3]	0.375***	-0.057
Tenderloin weight	141	3.42	16.6	-0.121	0.045	0.220[3]	0.167	-0.184*
Fat trim weight	141	1.10	36.4	-0.020	0.192*	0.137	0.238**	-0.011

Conclusions Significant correlations between carcass yield and tenderness were favourable, indicating no antagonism between these traits. Significant associations were found between carcass characteristics and colour, suggesting that the redness and yellowness of the meat colour increases with carcass weight. Breed influenced meat colour but sex had no detectible effect.

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References

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