MEAT QUALITY TRAITS OF GRASS- AND GRAIN-FINISHED BRAHMAN CROSSES FOR DOMESTIC AND EXPORT MARKETS

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SUMMARY

Brahman females were mated to sires of eight breeds (Brahman, Santa Gertrudis, Belmont Red, Angus, Hereford, Shorthorn, Charolais and Limousin) to produce straightbred Brahman and F_1 crossbred calves in 1996. Calves were finished either on pasture in northern Australia or feedlot in northern or southern Australia for the domestic, Korean or Japanese markets. Differences between sire breeds for intramuscular fat percentage were not expressed in domestic market weight animals, where intramuscular fat percentage (IMF %) values were very low. At later market weights, differences between sire breeds in IMF % were consistent with increasing age. Based on peak force measurements, straightbred Brahman progeny consistently had the toughest meat at all market endpoints.

Keywords: *Bos indicus*, *Bos taurus*, crossbreeding, beef cattle, meat quality

INTRODUCTION

The five most important evaluative criteria in the choice of any given product are product quality, price, brand name/reputation, freshness and guarantee (Spitters *et al.* 1998). For food products, the key attribute is product quality and this is particularly true for beef. The Australian beef industry is facing up to the demands of the consumer by developing product quality assurance pathways (Meat Standards Australia, eg. http://msa.une.edu.au) that achieve a nutritional product through sensory quality (eg taste, tenderness, flavour, and marbling).

A primary objective of the Meat Quality CRC is to determine the effect of *Bos indicus* content on eating quality of animals of known genotype, growth path, backgrounding environment, finishing regime and slaughter process to develop MSA pathways for tropically adapted cattle. This study summarises analyses of meat quality traits from the first of three calf crops from the CRC Northern Crossbreeding Project.

MATERIALS AND METHODS

Brahman females were mated to sires of eight breeds representing *Bos indicus* (Brahman), *Bos indicus* x British-derived (Santa Gertrudis), Sanga x British derived (Belmont Red), British (Angus, Hereford, Shorthorn) and European (Charolais and Limousin) to produce straightbred Brahman and F_1 crossbred calves in 1996. Calves were born and raised to weaning on two properties in tropical central Queensland (Brigalow Research Station and "Duckponds") and raised on one property post-weaning (about 180 days). Approximately ↓ of animals were transferred to a southern grow-out property shortly after weaning, ↓ to the northern feedlot ("Goonoo") after an initial grow-out period and the remaining ↓ remained on Duckponds to be finished on pasture. Animals were finished for the Australian domestic market (average carcass weight = 220 kg) and the Korean (280 kg) or Japanese (340 kg) export markets. Animals remained on pasture to be finished on grain until live weight of the cohort averaged 300 kg (domestic) or 400 kg (export). Heifer progeny were slaughtered at domestic and Korean market weights, whilst steers were also slaughtered at Japanese market weights. One half of all steer progeny grown in northern Australia were implanted with repeated doses of Compudose 100® from about 15 months of age until slaughter. Steers transferred south and all heifers were not implanted. During the initial slaughters, problems occurred with electrical stimulation and the data were considered unreliable for meat tenderness measurements. These data were not included in the analysis. Exclusion of these data meant there were no meat tenderness data for pasture-finished steers. Protocols for measurement of meat quality data are described in Robinson *et al* (1998). Tenderness was measured on the *Longissimus dorsi* (strip loin) by Warner-Bratzler shear or Instron Compression. Intramuscular fat was measured either by chloroform extraction or near infrared spectroscopy. Cooking loss (measuring moisture loss) and pH (influences meat colour and tenderness) were also measured.

Data were analysed separately for each sex. In all models, sire within breed and kill group were fitted as random effects and sire breed, market (domestic, Korean and Japanese) and finishing treatment (feedlot north, feedlot south, pasture north) were fitted as fixed effects. HGP treatment (implant, control, and no treatment) was fitted to the model using steer data. Carcass weight was fitted as a covariate within market endpoint to adjust all data to a common carcass weight according to target market weight. No interactions were fitted in the model because of missing sub-classes.

RESULTS AND DISCUSSION

Table 1 shows the effects of sire breed on intramuscular fat percentage (measurement used by the CRC to indicate marbling) and measures of meat tenderness in steers and heifers. Angus, Belmont Red and Shorthorn sires consistently produced progeny with the highest intramuscular fat percentages. Based on all indicators of meat toughness (cooking loss, ultimate pH, peak force and instron compression), purebred Brahman sires produced progeny with the toughest meat. Average peak force values in both Brahman steers and Brahman heifers were above acceptable values for tenderness, indicating that consumers would deem a high proportion of Brahman carcases unacceptably tough. Sire breed differences in instron compression were not as evident as in other indicators of toughness. Instron compression is believed to be a better indicator of toughness due to collagen content than peak force measures. This suggests that collagen content is not an issue with respect to toughness in these animals, although all animals in this dataset were less than 2.5 years of age at time of slaughter.

The effects of market endpoint and finishing regime on intramuscular fat percentages and indicators of meat tenderness in steer and heifer progeny are shown in Table 2. As animals increased in age and slaughter weight from domestic to Korean to Japanese markets, intramuscular fat percentages increased in both steer and heifer progeny. However, meat toughness did not significantly increase with increasing age or carcase weight in either steers or heifers. These results suggest that the common practice of incurring fixed costs of slaughtering animals at lighter weights for the Australian domestic market to ensure a tender product is a fallacy and that considerable cost savings might accrue to processors and retailers who slaughter animals at heavier weights, without any detrimental effects on meat tenderness.

Table 1. Effects of sire breed on meat quality traits in steers and heifers. All means are adjusted to a common carcase weight within market endpoint (domestic, Korean or Japanese)

Sire Breed	No.	IMF[A] (%)	CL (%)	pH	No.	PF (kg)	IC (kg)
Steer Progeny							
Angus	23	2.66	22.5	5.57	14	4.58	1.72
Belmont Red	77	2.62	22.7	5.55	47	4.78	1.70
Brahman	78	1.95	23.7	5.55	50	5.89	1.81
Charolais	17	1.98	22.8	5.57	11	4.90	1.79
Hereford	20	2.41	22.0	5.58	11	4.64	1.84
Limousin	39	1.89	22.5	5.56	24	4.63	1.75
Santa Gertrudis	33	1.96	23.1	5.56	22	5.01	1.80
Shorthorn	15	2.62	21.3	5.59	10	4.76	1.73
Heifer Progeny							
Angus	22	3.35	21.9	5.56	21	4.54	1.77
Belmont Red	75	2.74	22.4	5.54	71	5.11	1.79
Brahman	93	2.16	22.8	5.57	85	5.90	1.86
Charolais	23	2.22	22.8	5.56	20	5.12	1.87
Hereford	26	2.52	22.6	5.55	25	4.53	1.78
Limousin	40	2.12	22.1	5.57	37	5.03	1.84
Santa Gertrudis	50	1.84	22.6	5.55	49	4.93	1.82
Shorthorn	18	3.23	21.9	5.55	18	4.83	1.72

[A]IMF = intramuscular fat, CL = cooking loss, pH = ultimate pH, PF = peak force and IC = instron compression

Grain finishing substantially increased intramuscular fat percentages in both northern and southern feedlot environments relative to pasture finishing in the north. The ultimate pH of animals finished on grain in the south was consistently lower than the ultimate pH of animals finished on either grain or at pasture in the north. This may be an effect of abattoir, as early kill groups finished in the north were slaughtered at a different abattoir to those finished in the south. Additional data are required to confirm this result. There were no reliable meat tenderness data available for steers that were finished at pasture in the north. However, heifers finished at pasture in the north were consistently tougher than heifers finished in either northern or southern feedlot environments, whether toughness was measured by peak force or instron compression.

Table 2. Effects of market endpoint on meat quality attributes in steers and heifers

Market or finishing regime	No.	IMF[A] (%)	CL (%)	pH	No.	PF (kg)	IC (kg)
Steer Progeny							
Domestic	115	1.65	22.5	5.55	75	4.99	1.70
Korean	113	2.28	21.9	5.57	77	4.52	1.81
Japanese	74	2.85	23.3	5.59	37	5.18	1.78
Feedlot north	113	2.30	22.0	5.58	113	4.71	1.78
Feedlot south	113	2.74	22.8	5.50	76	5.09	1.75
Pasture north	76	1.74	22.9	5.62	n.a.	n.a.	n.a.
Heifer Progeny							
Domestic	169	2.41	22.0	5.54	148	4.88	1.71
Korean	178	2.63	22.8	5.57	178	5.12	1.91
Feedlot north	117	2.09	21.4	5.58	117	4.77	1.67
Feedlot south	111	3.90	22.0	5.47	111	4.74	1.75
Pasture north	119	1.58	23.7	5.62	98	5.48	2.01

[A]See Table 1 for meaning of acronyms

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