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THE EFFECT OF SEX AND GENOTYPE IN CATTLE ON FEEDLOT PERFORMANCE, CARCASE CHARACTERISTICS AND MEAT QUALITY

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SUMMARY

Fifty-five Hereford and 40% and *60% Bos indicus* infused multibreed composite yearling bulls and steers were lot-fed for 77 days. Behaviour in the feedlot was similar for bulls and steers and for all genotypes. Feedlot growth rate was higher for the bulls ($P < 0.05$) than the steers, but no significant differences for growth rate were detected between the genotypes. No significant differences were found between sexes or genotypes for carcase characteristics except for the greater percentage fat trim in steers than bulls ($P < 0.05$) and the greater P8 fat thickness in Herefords than the other two genotypes ($P < 0.05$). Sex or genotype had no significant effect on muscle colour, fat colour, marbling score or muscle pH. Meat from bulls with *40% Bos indicus* content was tougher ($P < 0.05$), as measured by shear force, than that from all other groups.

Keywords: genotypes, feedlot, carcase, bulls, meat quality.

INTRODUCTION

The production of quality beef in Australia has been traditionally from young castrate male cattle, while in many European countries entire males are preferred (Fiems *et al*. 1990). Preference for steer beef in Australia was clearly identified by Hinch and Thwaites (1984) where lack of acceptance of bull beef was principally due to management difficulties, buyer resistance and finishing difficulties with the perception being that inferior meat quality characteristics more than outweigh any production and yield advantages.

With the rapid expansion of the feedlot industry (Tucker *et al*. 1991) and the need to adopt systems that optimise production, consideration of the use of bulls to produce high quality meat is warranted. *Bos indicus* infused genotypes have commonly been discriminated against due to lower meat quality (Ramsay *et al*. 1963; Luckett *et al*. 1975; Peacock *et al*. 1982; Crouse *et al*. 1989; Johnson *et al*. 1990). Research into the effect of genotype on feedlot performance and meat quality is necessary as the supply of traditional British breed cattle is frequently insufficient to meet demand.

The aim of this study was to compare animal performance, carcase characteristics and meat quality of yearling bulls and steers of British and *Bos indicus* infused genotypes when finished under feedlot conditions.

MATERIALS AND METHODS

Hereford bulls (HB) and steers (HS), multibreed composite *Bos indicus* infused bulls (40B) and steers (40S) of *40% Bos indicus* content together with 60% *Bos indicus* infused bulls (60B) and steers (60S) were used in this study. All animals were bred on the 1 property and run as 1 group from birth until entering the feedlot at 10-11 months of age.

Cattle of the same sex and genotype were fed together in a single group. After an introductory phase of 14 days the 6 groups of cattle were lot-fed for 77 days on a diet of 85% concentrate and 15% roughage. Final liveweights were taken at the end of the feedlot phase. Ease of animal handling and behavioural characteristics plus the total weight of feed consumed for each group were recorded. A subgroup of animals was slaughtered over a period of 30 days with slaughter cattle from each pen being selected to have similar age. A routine was established where animals were drafted at 1500 hours and transported 1 km by road to the abattoir. The animals were weighed at 0600 hours the morning after arrival and then slaughtered. Carcases were dressed according to AUS-MEAT hot standard carcase specifications after which the hot carcase weight was obtained together with the weight of fat trim and bruising trim if present. Carcases were not electrically stimulated.

After the carcases had been chilled for 24 hours at 2°C, AUS-MEAT chiller assessment procedures (Anon 1990) were carried out as follows. Subcutaneous fat depths were measured at the 12th rib (FT12) and rump (P8) sites. Eye muscle area was measured at the 12th rib. A fat colour score (scale 1-10, from 1 creamy white to 10 dark yellow) and a butt profile score (scale A-E, from A convex to E concave) were given to each carcase. Marbling was visually assessed using a 12 point marbling score system (0 nil marbling, 12 heavy marbling) at the 12th rib section of the *M. Zongissimus dorsi*. Meat colour was

assessed at this position on a scale of l-9 (1 pink to 9 dark red).

Muscle pH was measured by inserting the probe deep into the cut surface of the *M. Zongissimus dorsi*. A sample of this muscle was taken at the 12th rib from each carcase, frozen at -25°C and stored until required for meat quality assessments. Frozen muscle samples were prepared using the technique described by Taylor and Cornell (1985) and subjected to Warner-Bratzler shear force determination and tenderness evaluation by taste panel. Taste panel members (8 males and 2 females) were requested to rate tenderness on a lo-point descriptive scale, 10 being extremely tender and 0 being extremely tough. Estimated lean mean yield was calculated by using the equation presented by Anon (1990).

Data was analysed using analysis of variance and least squares, fixed model procedures (SAS 1988). Food conversion was not subjected to statistical analysis.

RESULTS

Bulls had higher liveweight gain ($P < 0.05$) when compared with steers (Table 1). Differences between genotypes in daily liveweight gain were not evident, however there was a trend for decreased feed conversion efficiency as the *Bos indicus* content increased.

Table 1. Initial liveweight, food conversion efficiency and least square means of feedlot liveweight gain of bulls and steers of 3 breed types

	Genotype						SE
	HB	HS	40B	40S	60B	60S	means
Number of animals	11	8	12	12	7	5	
Initial liveweight (kg)	319.6	277.3	387.3	373.8	371.6	368.6	
Food conversion (kg feed/kg gain)	5.66	6.27	6.17	6.63	6.19	6.88	
Liveweight gain (kg/day)	2.24^a	1.78^b	2.17^a	1.74^b	2.19^a	1.75^b	0.23

Means for liveweight gain followed by a different superscript letter differ significantly ($P < 0.05$).

Carcase characteristics are presented in Table 2. Dressing percentage was similar in bulls and steers and for each genotype fat trim was significantly ($P < 0.05$) higher in all genotypes in steer carcases than in bull carcases. There was also a trend towards more fat trim as the *Bos indicus* content increased. Subcutaneous fat thickness at P8 was significantly greater ($P < 0.05$) in Hereford bulls and steers than in *Bos indicus* infused genotypes. However, FT12 fat thickness was not affected by either sex or genotype. Eye muscle area, although larger in bulls than in steers of each genotype, was significantly different ($P < 0.05$) only in Herefords. Butt profile and lean meat yield were not significantly affected by sex or genotype. No bruising was found in any of the carcases.

Meat quality characteristics are presented in Table 3. Sex and genotype had no effect on muscle colour, fat colour, marbling and muscle pH. The results of objective tenderness assessment by Warner-Bratzler shear force indicates a slight but nonsignificant advantage for steer meat. There was also a tendency for meat from *Bos indicus* derived genotypes to be a little tougher than meat from Hereford cattle. Meat from bulls of *40% Bos indicus* content was significantly tougher ($P < 0.05$), as measured by shear force, than that from all other groups. Subjective tenderness assessment by taste panel demonstrated the same order of differences between groups as those indicated by objective assessment.

DISCUSSION

Under the conditions of this experiment, bull behaviour was not a problem. This was most likely due to the young age of the bulls which behaved similarly to steers. Bruising was not encountered in either bulls or steers even though sexes were mixed in the abattoir holding yards prior to slaughter. Similar dressing percentages for bulls and steers of equivalent ages to those used in this experiment have been reported by Cahill *et al.* (1956), Carroll *et al.* (1975) and Yupardhi *et al.* (1990).

Young bulls, 14 to 15 months of age producing carcases up to 300 kg and displaying no secondary sex characteristics, produced meat of a quality similar to that from steers of the same age and genotype as judged by meat colour, marbling and muscle pH. There was a tendency for bull meat to be slightly tougher but not significantly so except for animals with *40% Bos indicus* content. There was also a tendency for toughness to increase when *Bos indicus* infusion occurred, which is in accordance with reports by Ramsay *et al.* (1963), Luckett *et al.* (1975), Peacock *et al.* (1982), Crouse *et al.* (1989) and

Table 2. Least square means of carcase data of young bulls and steers of 3 breed types

	Genotype						SE
	HB	HS	40B	40S	60B	60S	means
Number of animals	6	8	7	7	7	5	
Carcase wt (kg)	282.2	237.1	320.7	301.3	301.7	286.6	
Dressing (%)	57.9	56.2	57.7	56.7	57.4	57.4	1.88
Fat trim (%)	6.5^{d}	8.6^{ac}	7.2^{cd}	9.1^{ab}	8.1^{bcd}	10.3^{a}	1.65
Fat thickness 12th rib (mm)	8.3	11.2	6.1	8.3	8.6	10.4	2.67
Fat thickness P8 (mm)	15.6^{a}	16.0^{a}	7.4^{cd}	9.9^{bd}	9.4^{bd}	13.4^{ab}	5.12
Eye muscle area (cm^2)	84.8^{ab}	67.8^{cd}	93.1^{a}	87.1^{a}	76.0^{bc}	75.0^{bc}	10.5
Butt profile[A]	2.5	2.5	2.3	2.5	2.6	2.2	0.14
Est. lean meat yield (%)	61.0	58.8	61.7	60.8	59.6	59.0	3.07

[A]Butt profile was assessed on an A → E scale, A = 1 → E = 5, 1 is convex and 5 is concave.
Means in the same row followed by a different superscript letter differ significantly ($P < 0.05$).

Table 3. Least square means of meat quality characteristics of young lot-fed bulls and steers

	Genotype						SE
	HB	HS	40B	40S	60B	60S	means
Number of animals	6	8	7	7	7	5	
Muscle colour	4.5	4.6	4.1	4.3	4.0	3.6	1.04
Fat colour	2.8	2.4	2.4	2.6	2.4	2.4	1.07
Marbling	2.2	2.0	2.1	2.1	2.1	2.1	0.42
Muscle pH	5.53	5.49	5.54	5.55	5.51	5.52	0.15
Taste panel[A]	5.6^{bc}	6.4^{c}	3.4^{a}	5.4^{bc}	4.5^{ab}	5.2^{bc}	1.05
Shear force (kg)	4.9^{bc}	4.2^{c}	7.9^{a}	5.5^{bc}	5.8^{b}	5.3^{bc}	1.16

[A]Taste panel scores ranged from 1 (poor) to 10 (very good).
Means in the same row followed by a different superscript letter differ significantly ($P < 0.05$).

Johnson *et al.* (1990). The biological base of the tenderness problem associated with *Bos indicus* genotypes needs clarification before solutions are likely to be found. This difference may however be overcome to some extent by electrical stimulation of the carcases.

With similar lean meat yield and meat quality characteristics but superior live animal productivity, the use of young bulls fattened under feedlot conditions is likely to be more profitable than the fattening of steers. While this may be recognised in Europe, changes in attitude of Australian producers, processors, retailers and consumer- will be necessary before the production of meat from young bulls is widely accepted.

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