MEAT QUALITY OF 2.5 AND 3.5 YEAR OLD SHORTHORN, BRAHMAN, BRAHMAN X SHORTHORN AND AFRICANDER X SHORTHORN STEERS RAISED IN THE KIMBERLEY REGION OF WESTERN AUSTRALIA

D. PRATCHETT*, B.L. McINTYRE** and M.J. CARRICK**

SUMMARY

Meat quality characteristics of electrically stimulated carcases from steers of two age groups (2.5 or 3.5 years) and four breed types [Shorthorn (SH), Brahman (BR), Brahman x Shorthorn (BRSH), and Africander x Shorthorn (AFSH)] raised in the Kimberley Pastoral region were studied. M. longissimus of 2.5 year old cattle was significantly (P < 0.05) more tender by taste panel, shear force and adhesion tests and had a significantly (P < 0.05) lighter meat colour than 3.5 year old cattle. Taste panel and shear force tests showed that AFSH cattle were significantly (P < 0.05) more tender than the other breed types.

Keywords: cattle genotypes, meat quality.

INTRODUCTION

In the arid tropics of the Kimberley region of Western Australia the major cattle breed is the Kimberley Shorthorn which has been derived largely by natural selection from Shorthorn cattle taken there from Queensland in the 1870s to 1890s. In recent years Bos indicus cattle have been introduced into the herd to take advantage of increased growth resulting from superior heat tolerance and parasite resistance. Thompson and Barlow (1981) showed that meat from Brahman cross animals was inferior to that from Herefords and from Simmental and Friesian crosses. Similarly, work overseas has often shown meat from Bos indicus breeds to be inferior or equal in quality to that from British or European breeds (Carpenter et al. 1961; Luckett et al. 1975; Koch et al. 1982; McKeith et al. 1985).

The aim of this study was to compare meat quality characteristics of electrically stimulated carcases from 2.5 and 3.5 year old Kimberley Shorthorn (SH), Brahman (BR), Brahman x SH (BRSH), and Africander x SH (AFSH) steers.

MATERIALS AND METHODS

The cattle were raised at Ord Regeneration Research Station, 200 km south of Kununurra, Western Australia. The mean annual rainfall is 580 mm the majority of which falls during the hot *wet season* between December and April. They grazed on rangeland consisting of numerous native species oversown with Buffel grass (Cenchrus ciliaris), Birdwood grass (Cenchrus setiger) and Kapok bush (Aerva javanica). Stocking rate of 1 beast to at least 10 ha ensured that growth of the animals was not limited by feed quantity.

The steers were of eight genotypes, SH, BR, F1, F2 and F3 BRSH and F1, F2 and F3 AFSH and were born between December and February 1982/83 (3.5YO) or 1983/84 (2.5YO). They were branded and castrated in May and weaned at the end of July in the respective years. After weaning, all steers were grazed in common.

* Western Australian Department of Agriculture, Kununurra, W.A. 6743
** Western Australian Department of Agriculture, Baron-Hay Court, South Perth, W.A. 6151
Following muster in May 1986 the cattle were subjected to a 7-day dipping regime to ensure freedom from cattle tick and transported 3,200 km to the abattoir located in Perth, Western Australia. During the time between muster and slaughter (approx. 2 weeks) the cattle were fed hay.

Within 30 minutes of slaughter the carcases were electrically stimulated (600 volts R.M.S. half sinusoid; 14.3 pulses per sec.) for 2 minutes. Carcase weight (hot weight, less 3 per cent: fats out: tail off) and fat thickness between the 12/13th ribs were recorded. The carcases were placed in a chiller set at 2°C for 24 hours. Samples of M. longissimus between the 10/11th ribs and the 3/4th lumbar vertebrae were removed from 5 carcases of each of the 8 genotypes and 2 age groups. The carcases sampled were chosen at random from those available in each genotype. The number available ranged from 5 to 15 (none was available in the 3.5 y.o. F3 AFSH). Samples were frozen and stored at -25°C until required for meat quality assessments.

Assessments of tenderness score, shear force, adhesion and meat colour were carried out according to the procedures described by McIntyre and Ryan (1984).

The data were analysed by ordinary least squares (Harvey 1960). Data for the different generations of BRSH and AFSH were pooled on the assumption that differences due to heterosis for carcase and meat quality traits would be negligible. The effects for age, genotype and age x genotype were used in the least squares model. Differences among treatments were determined using LSD s calculated at the 5 per cent level of probability.

RESULTS

As shown in Table 1, 3.5 year old cattle had carcase weights almost 60 kg heavier and fat thickness 2 mm greater than the 2.5 year ‘olds. BR cattle had the heaviest and fattest carcases while SH had the lightest and leanest.

Age had a significant (P < 0.05) effect on all characteristics with 3.5 YO having the lowest tenderness score, highest shear force and adhesion and darker meat colour.

Tenderness scores showed that meat from AFSH cattle was significantly (P < 0.05) more tender than that from all other genotypes. Shear force values provided a similar indication although in this case there was a significant (P < 0.05) age x genotype interaction. Within 2.5 YO animals no significant (P < 0.05) differences were present among genotypes but AFSH has the lowest value. At 3.5 YO, BR had significantly (P < 0.05) higher shear force than the other genotypes, and AFSH, again had the lowest value. Within each genotype 2.5 YO cattle had lower ‘shear force than the 3.5 YO, the difference being significant (P < 0.05) only for BR and BRSH.
Table 1. Least squares means of carcass characteristics and meat quality characteristics of M. longissimus of steers of 2 ages and 4 genotypes

<table>
<thead>
<tr>
<th>Genotype</th>
<th>Carcase weight (kg)</th>
<th>Fat thickness (mm)</th>
<th>Tenderness score¹</th>
<th>Shear force (kg)</th>
<th>Adhesion (kg)</th>
<th>Meat colour score²</th>
</tr>
</thead>
<tbody>
<tr>
<td>SH</td>
<td>201.7</td>
<td>2.8</td>
<td>2.94</td>
<td>5.24ab</td>
<td>0.67</td>
<td>3.90</td>
</tr>
<tr>
<td>BR</td>
<td>237.1b</td>
<td>6.5c</td>
<td>3.05a</td>
<td>6.39c</td>
<td>0.62</td>
<td>3.90</td>
</tr>
<tr>
<td>BRSH</td>
<td>227.0b</td>
<td>4.9b</td>
<td>3.21a</td>
<td>5.26b</td>
<td>0.64</td>
<td>3.93</td>
</tr>
<tr>
<td>AFSH</td>
<td>221.2b</td>
<td>3.6a</td>
<td>3.60b</td>
<td>4.51a</td>
<td>0.57</td>
<td>4.13</td>
</tr>
</tbody>
</table>

P < 0.05 < 0.05 < 0.05 < 0.05 NS NS

<table>
<thead>
<tr>
<th>Age</th>
<th>Tenderness score</th>
<th>Shear force</th>
<th>Adhesion</th>
<th>Meat colour score</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.5 YO</td>
<td>193.7</td>
<td>3.5</td>
<td>4.58</td>
<td>0.56</td>
</tr>
<tr>
<td>3.5 YO</td>
<td>249.8</td>
<td>5.4</td>
<td>6.13</td>
<td>0.69</td>
</tr>
</tbody>
</table>

P < 0.05 < 0.05 < 0.05 < 0.05 < 0.05

Significant (P < 0.05) Age x Genotype interaction for shear force (kg)

<table>
<thead>
<tr>
<th>Age</th>
<th>SH</th>
<th>BR</th>
<th>BRSH</th>
<th>AFSH</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.5 YO</td>
<td>4.46ab</td>
<td>4.81ab</td>
<td>4.79ac</td>
<td>4.26a</td>
</tr>
<tr>
<td>3.5 YO</td>
<td>6.03bc</td>
<td>7.98d</td>
<td>5.74b</td>
<td>4.76ab</td>
</tr>
</tbody>
</table>

abcd Means followed by different letters differ significantly (P < 0.05)
1. Tenderness scores range from 1 = very tough to 6 = very tender
2. Meat colour scores range from 1 = very light to 6 = very dark.

DISCUSSION

An advantage in meat quality of AFSH cattle over the other genotypes has been indicated in this investigation. This was clearly shown in the results for the taste panel tenderness scores. Shear force measurements supported tenderness scores in that AFSH had the lowest value at both ages, although significantly (P < 0.05) different only from BR at 3.5 YO (Table 1). The significant (P < 0.05) interaction was due to differences among genotypes in the increase in shear force between 2.5 and 3.5 YO. While values for AFSH rose by 12 per cent those for BR rose by 66 per cent with SH and BRSH intermediate. The omission of the age x genotype interaction term from the least squares model made no difference to the significance level of the breed effect. In the analysis for tenderness score the age x genotype interaction did not approach significance (P = 0.86) and the decrease in score between 2.5 and 3.5 YO was similar for each genotype.
The relative importance of the advantage to the AFSH must be weighed against other characteristics such as growth rate, fertility, survival and the ability to attain a suitable level of fatness. Preliminary results from the present study in the Kimberley region show that the AFSH compare favourably in these characteristics. In the interests of improving meat quality from the pastoral herd there appears to be a case for the more widespread use of this breed type. Up to this time the use of Bos indicus breeds has been almost totally restricted to the Brahman.

Our finding that the introduction of Bos indicus blood in the form of the Africander had a significant (P < 0.05) beneficial effect on the meat quality of Bos taurus (Shorthorn) may indicate that the Africander are a "tender" Indicus breed. We have been unable to find any work in which the eating quality of Africander cattle has been compared with other breed types. The results for the BR and BRSH in our study are consistent with those of Carpenter et al. (1961), Thompson and Barlow (1981), Koch et al. (1982) and McKeith et al. (1985) who all found tenderness to be decreased (not always statistically significantly so) with the introduction of Brahman blood. McKeith et al. (1985) indicated that the inferior eating quality of Brahman cattle may have been associated with their tendency to have more angular shape than their contemporaries from other breeds resulting in a greater susceptibility to cold toughening. Luckett et al. (1975) suggested a similar explanation for differences in tenderness they found between Brahman and a number of other breeds. In the present study any possible effect of such differences in carcass characteristics should have been eliminated by the use of electrical stimulation.

The significant (P < 0.05) decline in meat quality from 2.5 YO to 3.5 YO clearly indicates the desirability of slaughter at the younger age if the meat is to be suitable for the high priced domestic market. This result differs from that of Bouton et al. (1978) who found no significant difference in shear force of M. semimembranosus and M. longissimus dorsi between 9 and 42 months in animals treated (by tenderstretch) to prevent cold toughening.

REFERENCES


