CHANGES IN THE ANATOMICAL COMPONENTS OF THE HINDQUARTERS OF HEREFORD AND BRAHMAN X HEREFORD F_1 STEERS WITH FATTENING

E.R. JOHNSON[A], *D.G. TAYLOR*[B] *and L.M. KNOTT*[A]

[A]Division of Farm Animal Studies, The University of Queensland, PO Box, 125, Kenmore, Qld 4069
[B]Animal Production, Gatton College, The University of Queensland, Lawes, Qld 4343

SUMMARY

The weights of the anatomical components in the hindquarters of Hereford and Brahman x Hereford F_1 steer carcases, weighing from 88.4 kg to 351.8 kg were compared. Regression analyses showed that the Brahman x Hereford hindquarters had significantly less intermuscular fat relative to hindquarter fat weight and relative to hindquarter weight. In the regressions, the weights of subcutaneous fat, muscle and bone, and muscle-bone ratio did not vary significantly between genotypes. A comparison of hindquarters, from 30 kg to 90 kg at 10 kg intervals, showed that from a carcase weight of approximately 200 kg to 360 kg, the *taurindicus* hindquarters had a significantly lower weight of intermuscular and total fat and significantly heavier bone. From 240 kg to 360 kg carcase weight, the *taurindicus* hindquarters had significantly heavier muscle. There were no significant differences between subcutaneous fat weights and muscle-bone ratios.

Keywords: Hereford, *taurindicus*, anatomical components, hindquarter

INTRODUCTION

Beef carcase evaluation systems which include conformation or shape score usually appraise this feature on the hindquarter (Anonymous 1987; Eldridge and Ball 1992). The domestic market which trades many Hereford and *taurindicus* types may pay premiums of up to $40 for a 'desirable' shape compared with carcases of a less 'desirable' shape. It is important, therefore, to understand the underlying cause of differing hindquarter shape. Taylor *et al.* (1990), Eldridge and Ball (1992) and Johnson *et al.* (1996) attributed hindquarter shape differences to fat, particularly subcutaneous fat, but a feature of these studies was that not all hindquarter components were fully examined.

In the current study, all anatomical components of the hindquarters of two groups of steers, Hereford and Brahman x Hereford F_1, were examined to determine their possible influence on hindquarter shape.

MATERIALS AND METHODS

Twenty-seven Hereford and 25 Brahman x Hereford F_1 steers were serially slaughtered from 197 kg to 614 kg liveweight, producing carcases which ranged from 88.4 kg to 351.8 kg. When the carcases were chilled, one side from each was divided into forequarter and hindquarter at the 10th rib and both quarters were dissected into their anatomical components, muscle, bone, subcutaneous fat, intermuscular fat and connective tissue. Shape scores , assessed by an AUS-MEAT Chiller Assessor, were Herefords (10A, 4B, 11C and 2D) and Brahman x Hereford (6A, 3B, 13C and 3D).

Regression analysis was used to study the growth of hindquarter subcutaneous and hindquarter intermuscular fat relative to hindquarter fat weight, and all anatomical tissues relative to hindquarter weight.

RESULTS

Regressions of subcutaneous (SC) and intermuscular (IM) fat of the hindquarter over hindquarter fat weight (Figure 1A) and over hindquarter weight (Figure 1B) are shown for the two genotypes. Relative to hindquarter fat weight, the Brahman x Hereford (Ti) carcases had more hindquarter subcutaneous fat than the Hereford (H) carcases at all stages, but less hindquarter intermuscular fat. When compared on the basis of hindquarter weight, the cross-bred carcases had less hindquarter subcutaneous fat and less hindquarter intermuscular fat. In all regressions, the only significant difference between genotypes was in the slopes for hindquarter intermuscular fat.

Figure 2 shows the regressions of hindquarter muscle weight and hindquarter bone weight on hindquarter weight. There were no significant differences between the slopes or intercepts of either carcase component, between genotypes.

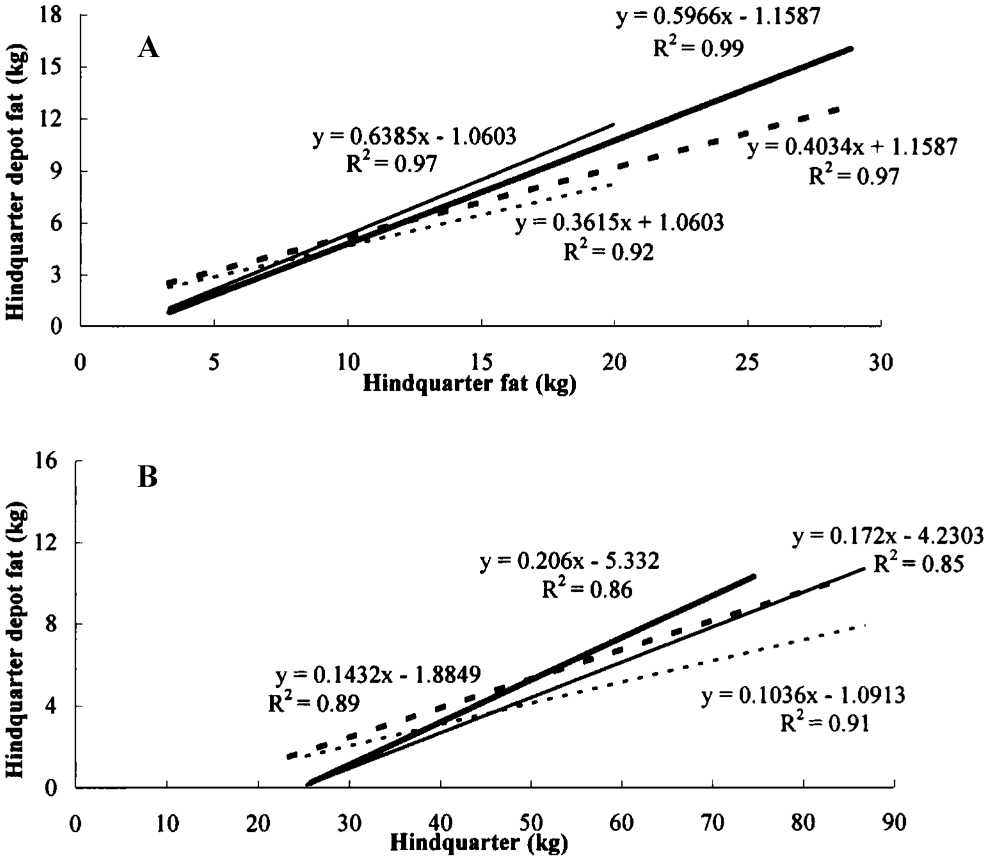

Figure 1. Relationships between subcutaneous and intermuscular fat of the hindquarter and (A) hindquarter fat weight and (B) hindquarter weight

SC(H) SC (Ti) IM (H) IM (Ti)

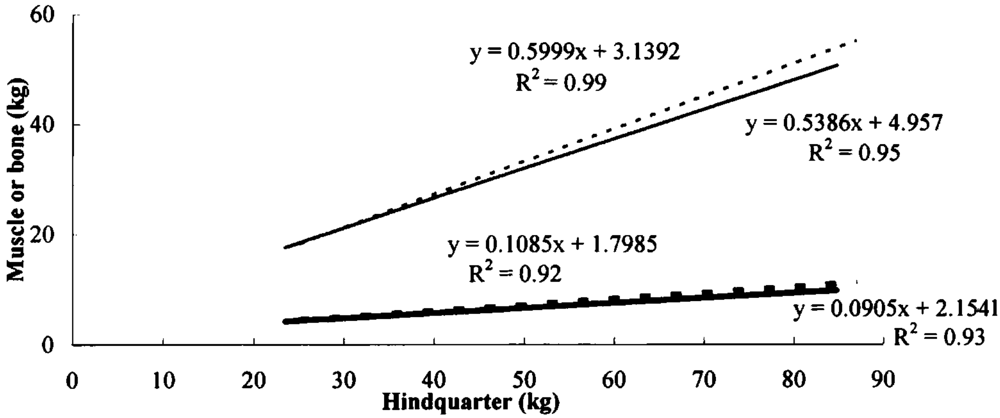

Figure 2. Relationships between hindquarter muscle weight and hindquarter weight

Muscle (H) Muscle (Ti) Bone (H) Bone (Ti)

Figure 3 shows regressions of muscle-bone ratio on hindquarter weight for the two genotypes. There were no significant differences between slopes or intercepts.

In Table 1, the weight differences in hindquarter components are compared between genotypes.

DISCUSSION

There were minimal compositional differences in the anatomical components of the hindquarters of Hereford and Brahman x Hereford steer carcases in the present study, which covered a weight range from veal to heavy export carcases. In the regressions, only intermuscular fat varied significantly between genotypes. Table 1 gave an indication of differences in hindquarter components as the cattle grew from veal to domestic carcase weight and then on to export weights. Once again the role of intermuscular fat was shown to be important. Up to about 160 kg carcase weight, there were no significant differences between hindquarter components. At about 200 to 240 kg carcase weight, the Herefords had 1.8 to 2.5 kg of extra hindquarter fat, attributable mainly to intermuscular fat, and the *taurindicus* hindquarters showed a significantly greater weight of muscle. At export carcase weights, the Hereford hindquarters had significantly more total fat, made up principally of intermuscular fat (2.4 to 2.8 kg) and significantly less muscle (approximately 3 to 3.7 kg). Commercially, the differences between the two genotypes are probably not very important up to 200 kg

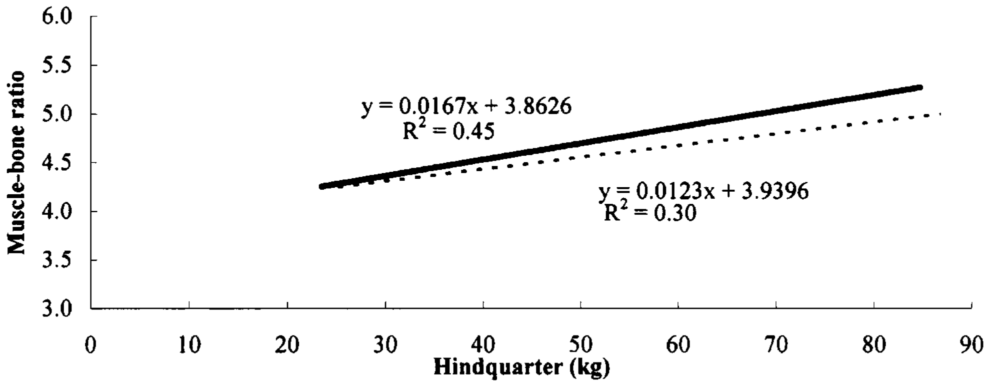

Figure 3. Relationships between hindquarter muscle-bone ratio and hindquarter weight

Muscle-bone ratio (H) Muscle-bone ratio (Ti)

Table 1. Weight differences in components of *taurindicus* hindquarters relative to Hereford hindquarters

	Hindquarter weight (kg)[a]						
Component	**30**	**40**	**50**	**60**	**70**	**80**	**90**
SC fat	ns	ns	ns	ns	ns	ns	ns
IM fat	ns	ns	-1.186	-1.582	-1.978	-2.374	-2.770
Total fat	ns	ns	-1.782	-2.519	-3.254	-3.990	-4.725
Muscle	ns	ns	ns	+1.860	+2.473	+3.087	+3.700
Bone	ns	ns	+0.548	+0.730	+0.910	+1.091	+1.272
M/B ratio	ns	ns	ns	ns	ns	ns	ns

[a] Hindquarter weight x 4 is approximate carcase weight.

SC Subcutaneous; IM Intermuscular; M/B Muscle to bone; ns, not significant.

All differences shown are significant (P<0.05).

carcase weight because the extra intermuscular fat would be sold, legitimately, as beef. Beyond 200 kg, muscle differences began to become important and any suggested 'superiority' in shape was not supported by the excess fat and lower muscle content. However, this does not involve all cattle. Some carcases, even when corrected for fatness, do show a range in muscle-bone ratio (Kempster 1978; Purchas *et al.* 1991).

Over all weight ranges, subcutaneous fat and the important muscling indicator, muscle-bone ratio did not vary significantly. It is likely that, up to 200 kg carcase weight, shape differences between the hindquarters of *taurindicus* and Hereford cattle are not commercially important, but after 200 kg, shape and yield are negatively correlated (Harrington 1972; Dumont 1978; Kempster 1978).

A problem with scientific studies of shape differences in carcases is, that for over 40 years, shape has been studied mainly by reference to weights or proportions of carcase components (Butler *et al.* 1956; Callow 1961; Kempster 1978; Taylor *et al.* 1990; Johnson *et al.* 1996) and not by morphometric methods. On a weight basis, intermuscular fat in the current study seems likely to play a greater role in shape differences than subcutaneous fat, even though Callow (1961) and Butterfield (1966) noted that subcutaneous fat was the component best positioned to influence shape. Perhaps the shape differences between British and *taurindicus* types are genotypic expressions which are better explained by a morphometric approach, whereas the weight of carcase components is more of a commercial statement.

REFERENCES

ANON (1987). AUS-MEAT Language, Authority for Uniform Specifications Meat and Livestock (Australian Meat and Live-stock Corporation: Sydney).

BUTLER, O.D., WARWICK, B.L. and CARTWRIGHT, T.C. (1956). *J. Anim. Sci.* **15**, 93.

BUTTERFIELD, R.M. (1966). *Aust. Vet. J.* **42**, 87-90.

CALLOW, E.H. (1961). *J. Agric. Sci., Camb.* **56**, 265-282.

DUMONT, B.L. (1978). *In* 'Patterns of Growth and Development in Cattle', (Eds H. De Boer and J. Martin), pp. 133-147 (Martinus Nijhoff: The Hague).

ELDRIDGE, G.A. and BALL, C.I. (1992). *Proc. Aust. Soc. Anim. Prod.* **19**, 61-64.

HARRINGTON, G. (1972). Farmer's Weekly, London.

JOHNSON, E.R., TAYLOR, D.G. and PRIYANTO, R. (1996). *Proc. Aust. Soc. Anim. Prod.* **21**, 185-88.

JOHNSON, E.R., TAYLOR, D.G. and KNOTT, L.M. (1997). *Proc. 43rd Int. Cong. Meat Sci. Technol.*, Auckland, New Zealand.

KEMPSTER, A.J. (1978). *In* 'Patterns of Growth and Development in Cattle', (Eds H. De Boer and J. Martin), pp. 149-166 (Martinus Nijhoff: The Hague).

PURCHAS, R.W., DAVIES, A.S. and ABDULLAH, A.Y. (1991). *Meat Sci.* **30**, 81-94.

TAYLOR, D.G., MEEHAN, D.P., JOHNSON, E.R. and FERGUSON, D.M. (1990). *Proc. Aust. Soc. Anim. Prod.* **18**, 392-95.