ANATOMICAL FACTORS INFLUENCING BUTT SHAPE OF STEERS PREPARED FOR THE AUSTRALIAN DOMESTIC MARKET

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SUMMARY

The relationships between butt shape and the anatomical components of the butt and side were studied in domestic beef car-cases derived from *Bos taurus*, *Bos indicus* and *Taurindicus* steers. Whether the study involved butt or side components, as butt shape changed from E to C, P8 fat thickness increased from 0 to 10 mm and significant increases occurred in the proportions of total fat ($P<0.01$), subcutaneous fat ($P<0.001$) and subcutaneous to intermuscular fat ratio ($P<0.001$). Butt shape was not significantly related to the proportions of intermuscular fat, total muscle or total bone. Because butt shape was strongly related to carcase fat content, particularly subcutaneous fat, which is measured objectively in the Australian domestic beef carcase classification system, its use in the AUS-MEAT language is not warranted.
Keywords: butt shape, steers, anatomical factors

INTRODUCTION

A shape score is used in many beef car-case description systems throughout the world (Jones *et al.* 1977; Bass *et al.* 1981; Kempster *et al.* 1982; Sorenson 1988). AUS-MEAT recommended the use of butt shape in its descriptive language about 8 years ago (Anon.1987) but withdrew it as a mandatory measurement following the conclusion of Thornton (1991) that "there is no indication of a useful role for butt profile in the estimation of saleable beef yield". Although butt shape is now optional, it is still widely used in the marketing of car-cases where it exerts considerable economic influence. Shape scores A, B and C are traded at higher prices than scores D and E, and price differences at the same carcase weight may be as great as $40.

In a study of carcase growth, Taylor *et al.* (1990) found that butt shape was more closely related to fat than muscle. However, their study included many heavy and fat car-cases covering a wide range of weights. Johnson *et al.* (1991) noted that the quantification of carcases was more likely to be statistically successful when there was a wide range in carcase weights and Priyanto (1993) found that maturity type differences associated with genotype were more likely to manifest themselves in heavier, fatter carcases.

If shape is associated with fatness as stated by Taylor *et al.* (1990) then a study of lighter, less fat (domestic) car-cases may show different relationships between shape score and carcase components.

In the following study, anatomical differences in domestic beef car-cases associated with changing butt shape in a group of *Bos taurus*, *Bos indicus* and *Taurindicus* steers are described.

MATERIALS and METHODS

Cattle and carcases

Fifteen Hereford, 13 Brahman and 12 Brahman x Hereford F1 steers were raised on native pasture, Kikuyu and good quality luceme hay, then sequentially slaughtered; liveweights at slaughter ranged from 200 to 450kg. Hot standard carcase weights were similar among genotypes and ranged from 94 to 232kg. After the sides were chilled for 24 hours at 3°C, rump P8 fat thickness (Moon 1980) was measured and butt shape evaluated by an experienced assessor according to AUS-MEAT's standards (Anon 1987). Of the 5 butt shapes scored by AUS-MEAT, only C, D and E were involved in this study.

Dissection

The right side of each carcase was quartered at the 10th rib, divided into 13 primal cuts suitable for the domestic market (Johnson and Charles 1981), then trimmed into wholesale cuts and manufacturing beef, together constituting 'saleable beef yield'. All products, edible and waste, were dissected into their component tissues, muscle, bone, fat and connective tissue. At all stages of cutting, trimming and dissection, subcutaneous and intermuscular fat depots were weighed separately. The butt consisted of topside, silverside, thick flank and shank which were described by Johnson and Charles (1981).

Statistical analyses

Pearson correlation coefficients, employing a 2-tailed test, were used to examine correlations between shape score and various car-case components.

RESULTS

Figure 1 shows the change in muscle and fat proportions in the butt associated with changing rump P8 fat thickness and butt shape. As fat thickness increased from 0 to 10 mm, butt shape changed from E to C, fat proportion rose by about 8% in all 3 genotypes and muscle proportion fell by about 5%. The mean values of P8 fat thickness for butt shape were E (2.8 mm), D (3.0 mm) and C (4.8 mm).

Table 1 shows the composition of the butt for the 3 butt shapes. Total fat percentage in the butt rose from 12.2 to 15.2 as butt shape changed from E to C, attributable to a significant (P<0.001) increase in subcutaneous fat as rump P8 fat thickness increased from 5.5 to 8.6 mm. Intermuscular fat percentage did not change significantly but the ratio of subcutaneous to intermuscular fat rose (P<0.001) as butt shape changed from E to C. Butt shape was not significantly related to the changes in muscle and bone proportions.

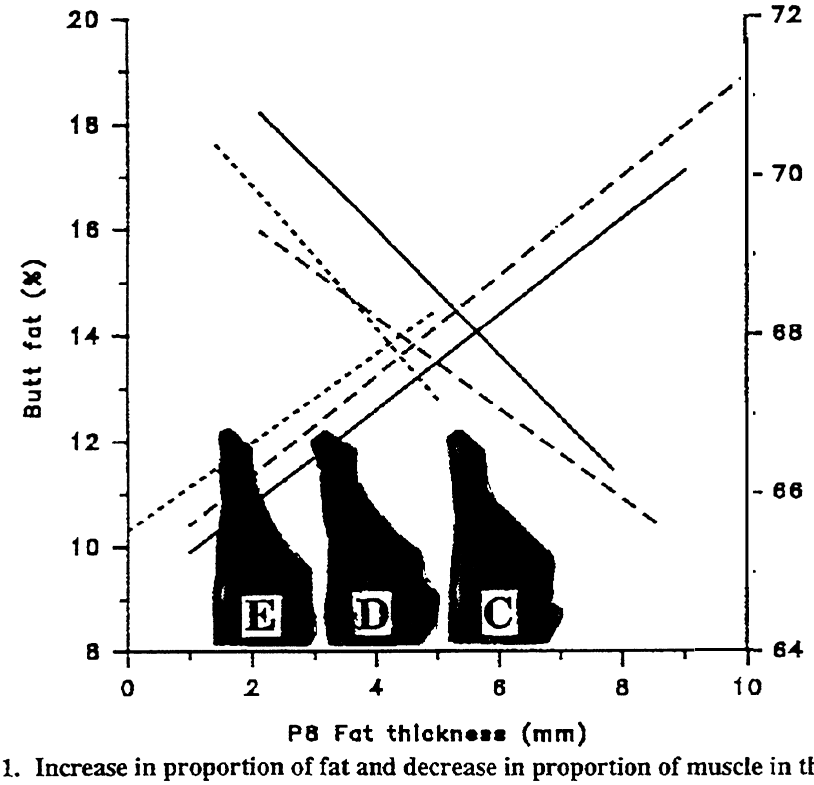

Figure 1. Increase in proportion of fat and decrease in proportion of muscle in the butt with increasing P_8 fat thickness (—— Brahman - - Hereford ··· Brahman X Hereford)

When the composition of the side relative to butt shape was examined (Table 2), the findings were similar to those for butt composition. As butt shape changed from E to C, total side fat percentage rose from 14.8 to 17.8 (P<0.01) which was due entirely to increasing subcutaneous fat (P<0.001), and the ratio of subcutaneous to intermuscular fat rose ($P<0.001$). The relationships between butt shape and intermuscular fat, muscle and bone were not significant.

Table 1. The relationship of butt shape to butt composition in 40 Australian domestic steer carcases

Anatomical character[A]	Butt shape C	Butt shape D	Butt shape E	R^2
Total fat (%)	15.2	12.0	12.2	0.21**
Subcutaneous (SC) fat (%)	8.6	6.5	5.5	0.30***
Intermuscular (IM) fat (%)	6.6	5.5	6.7	0.11 NS
Total muscle (%)	67.4	69.2	68.5	0.08 NS
Total bone (%)	14.8	15.9	16.5	0.12 NS
SC fat wt. / IM fat wt. (ratio)	1.32	1.23	0.85	0.28***

[A] From dissection of right side.
** $P<0.01$; *** $P<0.001$; NS Not significant.

Table 2. The relationship of butt shape to side composition in 40 Australian domestic steer carcases

Anatomical character[A]	Butt shape C	Butt shape D	Butt shape E	R^2
Total fat (%)	17.8	14.1	14.8	0.18**
Subcutaneous (SC) fat (%)	6.8	5.0	4.4	0.30***
Intermuscular (IM) fat (%)	11.0	9.1	10.4	0.10 NS
Total muscle (%)	63.9	66.3	65.2	0.01 NS
Total bone (%)	15.8	16.9	16.7	0.06 NS
SC fat wt. / IM fat wt. (ratio)	0.62	0.55	0.42	0.32***

[A] From dissection of right side.
** $P<0.01$; *** $P<0.001$; NS Not significant.

DISCUSSION

For the particular types of cattle used in this study, the finding was clear-cut. As butt shape changed from E to C ('improved'), P8 increased from 0 to 10 mm, the proportion of side fat rose, attributable largely or entirely to subcutaneous fat, and the proportions of side muscle and side bone did not change significantly.

Although the carcases studied were lightweight, with a relatively low fat cover and, therefore, free of the major manifestations of genotypic compositional differences (Priyanto 1993), subcutaneous fat still played an important role in the determination of butt shape. For a third of a century the importance of subcutaneous fat in influencing the external shape of animals has been acknowledged. Callow (1961) showed that the proportion of total fat which is deposited subcutaneously is a direct reflection of the amount of selection for beef characteristics which has taken place. Butterfield (1966) noted that subcutaneous fat is the body tissue which is best placed to influence external appearance and he remarked on its exploitation in the show ring. Eldridge and Ball (1992) acknowledged that the success of video image analysis in quantifying carcases is probably dependent on correcting for subcutaneous fat.

While the finding from this study would apply to many types of cattle grown for the Australian domestic market, it does not necessarily apply to all. The study, based on a shape criterion, is notable for not including cattle with high European breed content. Such highly-muscled types show fast and prolonged muscle growth and have less fat, particularly subcutaneous fat at domestic market weights. They may have different relationships between shape and carcase components. However, since most cattle supplying the domestic market are similar to the genotypes in this study, butt shape is unlikely to be a useful indicator of the commercial worth of domestic carcases. This finding supports the opinions of Taylor *et al.* (1990), Thornton (1991) and E.R. Johnson (unpublished) that butt shape is of little value in quantifying beef car-cases.

Because butt shape is strongly influenced by subcutaneous fat deposition which is always measured objectively in the Australian domestic classification system, its use in the AUS-MEAT language is not warranted. This is especially true in view of the low levels of carcase fat required by the Australian domestic market.

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