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SHAPE SCORE OF BEEF CARCASSES AS A PREDICTOR OF SALEABLE BEEF YIELD, MUSCLE AND FAT CONTENT

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SUMMARY

Carcass shape scores were subjectively assessed for 78 beef carcasses derived from approximately equal numbers of Hereford, Brahman and Brahman x Hereford steers over liveweight ranges from 200 to 600 kg. One side of each carcass was broken down into commercial cuts to establish saleable beef yield, and all cuts and trims were dissected to determine muscle and fat percentage of the side.

The relationship between shape score and yield percentage for the whole group of carcasses was extremely low, and only slightly better within each of the three breed groups. Shape score proved to be only moderately useful for the prediction of muscle and fat percentage of the carcass. When related to the composition of the butt of the carcass it was found that shape score was more closely related to fat percentage than to muscle percentage, and within the fat depots of the butt, shape score was related much more closely to the subcutaneous fat percentage than to the intermuscular fat percentage.

P8 fat thickness alone, and in combination with carcass weight, proved to be much better predictors of carcass percentages of saleable beef yield, muscle and fat, than was shape score. The addition of shape score to fat thickness, and fat thickness and carcass weight, provided no real improvement for the prediction of carcass yield or composition.

INTRODUCTION

The debate about the value of live animal and carcass conformation (or shape) for the prediction of carcass and meat quality attributes has continued for over 40 years (e.g. Knox and Koger 1946; Barton 1967; Kempster and Harrington 1980). Some workers have shown that carcass conformation has little or no influence on the percentage of high priced cuts in the carcass (Butler 1957; Branaman *et al.* 1962; Harrington 1971), whilst others have reported that carcasses with better conformation have higher yields and greater muscle content (Martin *et al.* 1966; Colomer-Rocher *et al.* 1980).

Many findings on this topic differ because of the confusion in the definition of conf onnation, the variety of assessment methods used and the type and breeds of cattle involved. The definition of conformation used by the European Association of Animal Production as "a visual assessment of the thickness of fat and muscle in relation to the size of the skeleton" (de Boer *et al. 1974)* is useful in the current discussion. More recently workers in this field have attempted to separate the effects of muscle and fat on shape assessment with the introduction of the concepts of "fat-corrected conformation" (Kempster and Harrington 1980) and "muscle score" (Hall 1988).

The work reported here investigates the relationship between conformation (or shape) score and saleable beef yield, muscle and fat percentages of the carcass.

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MATERIALS AND METHODS

The 78 cattle used in this study comprising 27 Hereford, 26 Brahman and 25 Brahman x Hereford steers, were allocated to slaughter group at random within breed at the commencement of the trial. There were five slaughter groups at 100 kg increments in live weight from 200 to 600 kg. Carcass conformation was assessed by an experienced operator using the AUS-MEAT shape scores current at the time of the commencement of the trial (Anon. 1986); numerical values were ascribed to these scores, A being most convex given a numerical *score* of 5, through to E being the most concave given a numerical score of 1. The right side of each carcass was broken into commercial cuts suitable for either the domestic or export Japanese markets, to establish saleable beef yield. Each of the resultant cuts, manufacturing trim and waste trims were then carefully dissected into bone, muscle, subcutaneous fat, intermuscular fat and connective tissue following the technique described by Johnson and Ball (1989).

Simple and multiple regression analyses (Seber 1977) were used to estimate carcass percentages of saleable beef yield, muscle and fat from various carcass measurements. Coefficients of determination (r^2) and standard error of estimates (s.e.) were calculated.

RESULTS

The general characteristics of the cattle used in this study are summarized in Table 1.

Table 1 Characteristics of the carcasses of the three breed groups

	Hereford (n = 27)		Brahman (n = 26)		Brahman x Hereford (n = 25)	
	Mean	Range	Mean	Range	Mean	Range
HSCW[a] (kg)	233	94-361	246	120-381	232	106-355
P8 fat thickness (mm)	8.7	1-25	7.9	1-20	6.2	0-16
Shape score[b]	2.2	1-4	2.9	1-4	2.6	1-4
Saleable beef yield (%)	69	65-73	71	67-74	71	69-73
Muscle (%)	62	54-69	63	56-70	64	58-69
Fat (%)	21	11-33	19	11-31	17	11-25

[a] HSCW, hot standard carcass weight
[b] Shape score, 5 = convex, 1 = concave

The relationship of the carcass shape score to yield, muscle and fat percentage of the carcass is shown in Table 2.

Table 2 The estimation of yield %, muscle % and fat % from shape score

	n	Using shape score to estimate					
		Yield %		Muscle %		Fat %	
		r^2	s.e.	r^2	s.e.	r^2	s.e.
Whole sample	78	0.00	1.82	0.10	3.11	0.27	4.70
Hereford	27	0.01	1.75	0.19	3.02	0.36	4.30
Brahman	26	0.11	1.93	0.40	3.16	0.45	4.98
B x H	25	0.03	1.25	0.33	2.10	0.41	2.93

r^2 coefficient of determination; s.e. standard error of estimates

Because the shape scoring procedure utilised in this work is principally an assessment of the carcass butt profile, the relationships between shape score and the muscle and fat percentages of the butt region (comprising the thick flank, topside, silverside and shank) were analysed. This analysis showed that shape score was more closely related to the fat percentage of the butt (r^2= 0.28, s.e. = 3.72) than to the muscle percentage of the butt (r^2 = 0.13, s.e. = 2.66). An analysis of the possible influence of fat distribution within the butt on the assessment of shape score showed that the relationship between shape score and subcutaneous fat percentage of the butt was moderate (r^2 = 0.36, s.e. = 2.86), while that between shape score and intermuscular fat percentage of the butt *was* very low (r^2 = 0.01, s.e. 1.44).

Simple and multiple regression analysis *to* establish the relationship between 'carcass measurements and the percentages of saleable beef yield, muscle and fat, with and without shape score are presented in Table 3.

Table 3 The estimation of yield percentage, muscle percentage and fat percentage from carcass measurements and shape *scores* (n = 78)

Predictor	Prediction of					
	Yield %		Muscle%		Fat%	
	r^2	s.e.	r^2	s.e.	r^2	s.e.
FT	0.13	1.70	0.59	2.22	0.77	2.65
FT + SS	0.17	1.67	0.59	2.23	0.77	2.63
FT + HSCW	0.21	1.63	0.59	2.23	0.78	2.63
FT + HSCW + SS	0.22	1.64	0.59	2.24	0.78	2.64

FT, P8 fat thickness; SS, shape score; HSCW, hot standard carcass weight
r^2, coefficient of determination, s.e., standard error of estimates

DISCUSSION

The extremely low r^2 value (Table 2) for the relationship between shape *score* and yield percentage for the whole sample (the r^2 is actually 0.0005) seriously questions the use of shape score (as conducted in this work) as a predictor of yield when applied to a population of diverse cattle types. The relationship within breeds was slightly better, but still very low. These results are in general agreement with those of Barton (1967) and Dikeman *et al.* (1977) which showed a poor relationship between conformation and yield.

Fat percentage of the butt accounted for approximately twice the variation in shape score compared to the amount of variation accounted for by muscle percentage; this was the case for the whole sample, and within each of the breeds. It is evident from these detailed dissection data that the subcutaneous fat of the butt apparently contributed significantly to the shape score assessment, and the intermuscular fat contributed very little to this assessment.

The results presented in Table 3 indicate that the P8 fat thickness measurement alone, or in combination with carcass weight, are much better predictors of carcass percentages of saleable beef yield, muscle and fat than is shape score (Table 2). It is clear that the addition of shape *score* to regression equations involving fat thickness, and fat thickness and carcass weight, added very little to the prediction of saleable beef yield percentage, and nothing to the prediction of muscle percentage and fat percentage.

Thus, beef carcass shape scoring, as conducted in this work on a range of carcass types, when related to detailed anatomical dissection and yield determination is of little value in predicting yield or carcass composition.

Further, there is no advantage in including shape score in prediction equations involving fat thickness and carcass weight for the estimation of yield percentage, muscle percentage or fat percentage of the carcass.

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