A STUDY OF SOME METHODS FOR THE ASSESSMENT OF MUSCLE AND FAT CONTENT OF LIVE CATTLE

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SUMMARY

Forty eight cattle with a wide range of weights, fatness, breed and age were assessed by two assessors for fat thickness using three assessment methods, and muscularity using three methods. Measurements were made of carcass fat thickness at two sites, eye muscle area, and half carcass muscle and fat weight were predicted. The palpation technique for fat thickness assessment in the live animal was easiest to learn and gave good correlations with carcass fat thickness and half carcass fat weight. The ultrasonic assessment of live animal fat thickness was more difficult to master but produced good correlations with carcass fat thickness. Visual assessment of fat thickness was learnt largely through experience and provided good correlation with sacral crest carcass fat measurement, but not with 13th rib fat measurement. Measurements of the forearm circumference and stifle-to-stifle distance gave good correlations with muscle weight in the half carcass, but only moderate correlations with eye muscle area. Visual assessment of muscling in the live animal gave only moderate correlations with eye muscle area and half carcass muscle weight.

INTRODUCTION

The recent interest in cattle marketing methods which provide an alternative to the auction system of selling has highlighted the need for a simple and accurate method of estimating fat thickness in the live animal. For the alternative marketing methods to operate effectively, and provide benefits for both producers and processors, one of the important requirements is that an accurate estimate of carcass fat thickness (in mm) be made on the live animal on the farm. The fat thickness assessment methods can be classified as visual appraisal (e.g. Fisher et al. 1981), palpation or handling (e.g. Loxton et al. 1982) and ultrasonic techniques (e.g. Tulloh et al. 1973; Graham et al. 1980).

The continuing trend in the beef industry towards more muscular cattle types emphasizes the need by producers for methods of estimating the muscle content of live cattle. This subject has received considerable research attention in the past, the techniques used including visual appraisal, body measurements and ultrasonic techniques.

The major objective of this study was to investigate the accuracy and usefulness of several methods of assessing fatness and muscling in live cattle for the prediction of carcass measurements of these attributes. A secondary objective was to gain an appreciation of the ease with which an inexperienced assessor can learn and master the techniques.

MATERIALS AND METHODS

Live animal assessments

A total of 48 cattle covering a wide range of breeds, ages, weights, fatness and sexes were assessed and measured independantly by two assessors. These two assessors were male, aged 21, both with a background in the cattle industry but no prior experience with the methods of assessment used.

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They were provided with some literature on each of the assessment techniques, and these techniques were demonstrated to them once before the commencement of the trial. The breed, age, liveweight and sex of each animal was recorded, and the following assessments made

i) Fat thickness by visual appraisal. An estimation of subcutaneous fat thickness in mm over the 13th rib was made by visual appraisal of the live animal, using the LMRS fat scores as a basis for assessment.

ii) Fat thickness in mm by palpation. The adaptation to the ESCA system, as described by Graham and Johnston (1982), was used.

iii) Fat thickness by ultrasonic technique. The Scanoprobe was used to measure subcutaneous fat thickness over the eye muscle over the 13th rib.

iv) Muscle score by visual appraisal. A five point scale was used (1 – light muscling, 5 – heavy muscling), with the addition of positive and negative signs to indicate the high and low ends of the range for each score.

v) Body measurements for muscling. The stifle-to-stifle or round measurement as described by Gregory (1933) was taken in cm using a flexible tape measure. The forearm circumference was measured in cm at a position on the foreleg halfway between the knee and elbow joints.

Carcass measurements

Each animal was slaughtered on the same day as the live animal assessments were made, and the following carcass measurements were taken

i) Hot carcass weight.

ii) Fat thickness in mm, at the 13th rib site and the sacral crest site, was measured according to the method of Johnson and Vidyadaran (1981).

iii) Eye muscle area at the 12th/13th rib quartering position was measured in square cm.

iv) Half carcass muscle and fat weight were estimated using the shin dissection techniques of Butterfield (1965) with the prediction equations adapted to cater for metric units.

Statistical analysis

Correlations between the live animal assessments and carcass measurements were computed using the SPSS program, as outlined by Nie et al. (1975).

RESULTS

Table 1 shows the simple correlation coefficients between the live animal assessments of fatness and the carcass fat thickness measurements and predicted half carcass fat weight.

TABLE 1 Correlation coefficients (r) between live animal and carcass assessments for fatness

		Live animal assessments		
		Visual	Palpation	Ultrasonic
Carcass Measurements	13th rib	0.30	0.51	0.55
	Sacral crest	0.62	0.67	0.64
	Half carcass fat weight	0.33	0.59	0.39

when $r \geq 0.288$ then $P < 0.05$ when $r \geq 0.372$ then $P < 0.01$

The correlation coefficients between live animal assessments for muscling and carcass muscle measurements are shown in Table 2.

TABLE 2 Correlation coefficients (r) between live animal and carcass assessments for muscling

		Live animal assessments		
		Visual	Stifle-to-stifle	Forearm circumference
Carcass Measurements	Eye muscle area	0.32	0.42	0.27
	Half carcass muscle weight	0.43	0.77	0.79

when $r \geq 0.288$ then $P < 0.05$ when $r \geq 0.372$ then $P < 0.01$

In all cases shown in Tables land 2 there were no significant differences in correlations for each set of assessments between the two assessors. The observations made by the two assessors on the live animal assessment methods can be summarized as follows

i) Visual assessment of fatness or muscling was not undertaken with any confidence initially, but with the experience of assessing the first 15 or 20 cattle and taking the corresponding carcass measurements, some confidence was developed.

ii) The palpation technique for assessment of fatness was easy to learn and gave reasonable assessments from early in the study.

iii) Some difficulty was encountered with interpretation of the Scanoprobe readings, and it was only through experience that the accuracy of assessment improved later in the study.

iv) Provided the animals were standing "square", the measurements taken to estimate muscling were not difficult to take.

DISCUSSION

The correlation coefficients relating the visual live animal assessment for fat thickness with carcass fat thickness and fat content (r = 0.30 - 0.62) are of the same order as those quoted in other reports. Loxton et al. (1982) reported correlations of 0.37 to 0.52 for this relationship when assessed by a number of operators using two visual assessment methods, Holland (1979) quoted correlations of 0.20 to 0.52 for five assessors using one visual assessment method on a large number of cattle, and Brackelsberg and Willham (1969) correlations of 0.29 to 0.44 with three assessors. All of the visual fatness assessment methods quoted above used a fat score (on a 5, 8 or 15 point scale), whereas the method used in this study was to estimate fat thickness in mm. As there does not appear to be any appreciable difference in the ranges of correlations, the assessment of fat thickness in mm is more desirable as it relates more directly to the carcass measurement. It should be noted that there was a higher correlation between visual fat assessment and sacral crest carcass measurement than there was between visual fat assessment and 13th rib carcass measurement. In at least 20% of the carcasses the 13th rib fat measurement site was damaged during dressing, the fat thickness measurement being consequently reduced. This lends support to the view expressed by Congram et al. (1982) that the sacral crest site provides a better fat thickness measuring position as it suffers less damage during dressing.

The palpation method provided better correlations than the visual method, and was found to be easy to learn. Loxton et al. (1982) reported correlations of 0.47 to 0.56 for live animal fatness assessment by palpation (into 6 fatness classes) related to carcass fat thickness. Fisher et al. (1981) reported on a procedure for assessment which combined visual and palpation procedures and recorded correlations ranging from 0.27 to 0.82 for 12 different judges. The procedure used in the present study of assessing fat thickness in mm achieved good correlations, and, as for visual fatness assessment, the results are more readily related to carcass measurement.

The ultrasonic assessment of fat thickness also produced good correlations, and although some problems in reading the instrument were encountered initially, proficiency improved as the trial progressed. Graham et al. (1980) using another type of ultrasonic instrument reported correlations of 0.701 to 0.913 when the instrument was operated by an experienced grader. Tulloh et al. (1973) using a third type of ultrasonic instrument quoted correlations of 0.83 to 0.94, again when operated by an experienced person.

Of the methods used for assessment of muscling it is apparent that either of the methods which consist of an objective measurement of a muscular part of the animal's body provided a good correlation with muscle weight in the half carcass. If an estimate of liveweight or carcass weight was included with the measure of live animal muscularity the prediction of carcass muscle weight should be improved. Visual assessment of muscling results in only moderate correlations with carcass muscle measurements.

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