Skinfold thickness, condition score and tritiated water space in Boran cattle

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SUMMARY

AN ATTEMPT *was made to use anal skinfold thickness as a quantitative measurement to estimate body fat in Boran cattle* (Bos indicus). *The normal single-operator technique gave a poor relationship between skinfold thickness and estimated total body fat, but this was greatly improved by using two operators. Nevertheless, the technique remained inferior to body condition score, which was very highly correlated with estimated body fat percentage. It was concluded that condition scoring provides a valuable index of the nutritional status of* Bos indicus *cattle, and that measurements of anal fold thickness are not applicable to such animals.*

INTRODUCTION

Liveweight *per se* is not necessarily a good indicator of body condition. Little and McLean (1981), for instance, have demonstrated that there is no predictive relationship between liveweight and body fat content in cattle in which total body fat varied over a fourfold range at similar liveweights. McLean et al (1983) showed that in cattle whose body weight decreased only slightly during the dry season, body fat reserves had decreased substantially and were largely replaced by water.

Scoring systems to estimate body condition or level of body fat reserves in cattle have been successfully used for both *Bos taurus* and *Bos indicus* cattle (Buxton, 1982; Lowman et al, 1976; Nicholson and Butterworth, 1986; van Niekerk and Louw, 1982; Wellington, 1981). Although the scores are subjective, they have been shown to be both repeatable and reproducible in both species (Jansen et al, 1985; Nicholson and Sayers, 1987a). There is also a high correlation between condition score change and changes in weight or heart girth (Nicholson and Sayers, 1987b).

In an attempt to develop a more objective approach than condition score for the routine assessment of body fat reserves in cattle, the measurement of anal fold thickness was evaluated. This was described by Charles (1974) as an accurate estimator of carcass fatness; when pinched up with a caliper, the anal fold consists of the skin and subcutaneous fat normally found between the *tuber ischii* and the base of the tail, and its thickness is indicative of the fat reserves in an animal's body. Johnson and Davis (1983) have demonstrated the applicability of the method for carcass fatness evaluation in both pure *Bos taurus* and *B. taurus* × *B. indicus* hybrids.

This paper reports a comparison of body condition scoring and anal fold thickness measurement in *B. indicus* cattle, in which body fat content was simultaneously estimated by tritiated water (HTO) dilution.

MATERIALS AND METHODS

Twenty-nine Boran cows with fasted liveweights averaging 350 kg (± 62 SD) were given condition scores on a scale varying from 1 (lean minus) to 9 (fat plus) with halfpoint steps according to the scoring system of Nicholson and Butterworth (1986). Following restraint in a headbail, anal fold thickness was measured as described by Charles (1974) by one operator using a Harpenden skinfold caliper modified for use on cattle (Johnson and Davis, 1983). It was found that the subcutaneous fat tended to pull away from the skin and was difficult to hold; a two-operator method was therefore devised in which one operator pinched the skin and underlying fat with both hands, while the second operator made three caliper measurements between them. In addition, dewlap thickness was measured in a few animals.

A known quantity of tritiated water was injected intramuscularly into each animal in the evening. After 14 hours, during which water and food were withheld, an equilibration blood sample was taken and fasted liveweight measured. Evening injection reduced the chances of unequilibrated tritiated water leaving the animal by evaporation. The blood was centrifuged and the activity of plasma water was measured directly in a pseudocumene cocktail using a Wallac liquid scintillation counter with an external channels ratio method for quench correction. Background plasma and an appropriately diluted HTO solution were used to prepare the standard. The methodology is discussed in detail by Nicholson (1987).

Total body water and total body fat (TBF) were calculated for each animal from HTO space and fasted liveweight (FLW), using the equations of Little and McLean (1981). The relationships between condition score, anal fold thickness (AFT) and TBF (expressed as a percentage of FLW) were examined using linear regression analysis.

RESULTS AND DISCUSSION

The data obtained for fasted liveweight and the estimated total body fat, condition score and anal fold thickness for the 29 Boran cows are given in Table 1. While the equations of Little and McLean (1981) were derived from data on *Bos taurus* and *B. taurus* × *B. indicus* hybrids, and were shown to be applicable over a wide range of body fatness, no pure *B. indicus* animals were involved in that study. It is possible, therefore, that they may not apply rigorously to such cattle for the estimation of total body fat in absolute terms. However, there is no reason to doubt that the estimates derived here are perfectly valid in a comparative sense, and that the comparison of condition score and anal fold thickness as estimators of total body fat is equally valid.

Table 1. *Mean and range of fasted liveweight, condition score, anal fold thickness and estimated total body fat in 29 Boran cows, Abernosa Ranch, Ethiopia, 1987.*

	$\bar{x}$ ± SD[1]	Range
Fasted liveweight (kg)	350 ± 62.1	256 – 471
Condition score	6.02 ± 1.63	2.5 – 9
Anal fold thickness[2] (cm)	1.21 ± 0.19	0.89 – 1.9
Anal fold thickness[3] (cm)	2.92 ± 0.88	1.4 – 4.6
Total body fat (% FL W[4])	22.4 ± 5.07	8.4 – 31.4

[1] SD = standard deviation.
[2] Measured by single operator.
[3] Measured by two operators.
[4] FLW = fasted liveweight.

The relationships calculated between estimated total body fat (% FLW, y) and the other parameters are:

$y = 2.81\ CS + 5.5$

r = 0.901;RSD = 2.23
(10% of mean y) (1)

$y = 12.6\ AFT_1, + 7.14$

r = 0.48; RSD = 4.53
(20% of mean y) (2)

$y = 3.92\ AFT_2 + 10.94$

r = 0.687; RSD = 3.75
(16.8% of mean y) (3)

where: CS = condition score,

RSD = residual standard deviation,

AFT_1, = anal fold thickness (cm) measured by one operator, and

AFT_2 = anal fold thickness (cm) measured by two operators.

Condition score provided the most reliable indicator of body fat percentage. AFT, was poorly correlated with total body fat, and although the underlying subcutaneous fat was more easily measured by using a second operator, this approach still produced a less precise estimate of body fat than did condition score. No other skin site appeared to offer a feasible alternative.

Although the measurements of anal fold thickness by Johnson and Davis (1983) produced an accurate estimate of carcass fat in both pure *B. taurus* and *B. taurus* × *B. indicus* hybrids, the technique was found unsuitable for *B. indicus* animals (E.R. Johnson, University of Queensland, Brisbane, Australia, personal communication). However, since this study found condition score to be closely correlated with estimated body fat percentage in these animals (equation 1), it was concluded that its use can provide valuable information in the routine assessment of their nutritional status.

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