A comparison of ultrasound backfat measurements on sheep

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ABSTRACT

Alternative methods of using an ultrasonic backfat probe on sheep were compared in 2 experiments involving 60 rams.

In both experiments, ultrasonic backfat measurements made on the side of the sheep opposite to the location of the operator and the second of 2 measurements had a higher correlation with carcass fat measurement C and were better predictors of percentage carcass fat than measurements taken on either the same side of the sheep as the operator or the first 2 measurements.

We conclude that different ultrasound backfat measurements vary in their value in predicting carcass fatness and individual operators should establish the most appropriate measurement.

Keywords Ultrasonic, backfat, sheep, techniques.

INTRODUCTION

A number of sheep selection programmes in New Zealand incorporate ultrasonic backfat depth (UFD) in an index of lean growth (Bennett *et al.*, 1983; Purchas *et al.*, 1985; Simm *et al.*, 1987). UFD measurements are time consuming and are normally recorded on both sides of the animal with the mean value used as the fatness predictor (Gooden *et al.*, 1980; Purchas and Beach, 1981; Fennessey *et al*, 1982). The genesis of this paper was a suggestion in earlier work (Nicol and Parratt, 1984) that there may be differences between UFD measure-ments in their usefulness as a predictor of carcass fatness.

This study was designed to determine the most accurate UFD by comparing repeated measurements from both sides of animals and different locations of the operator.

METHODS

Data were collected in 2 experiments.

Experiment 1

The animals (28 Border Leicester 1-year-old rams) and techniques used have been previously described (Nicol and Parratt, 1984). UFD over the 12th rib, 50mm from the mid-line was measured using an AIDD machine on the right and then left side of each ram on 2 occasions by 2 operators positioned on the true right side of the animal.

Experiment 2

Thirty two Border Leicester ram hoggets (mean live weight 65.7 $\pm$ 8.0 kg) had their UFD recorded on both sides on 4 occasions by 1 operator sitting on the right or left side (location) with either the right or left side of the animal measured first (order) followed by the opposite side. The 32 rams were al-located in blocks of 8 to a 4 x 4 Latin square incorporating all location x side combinations.

In both experiments live weight of each ram was recorded prior to slaughter. Rams were slaughtered in an export meat processing plant under normal procedures. Carcass weight and carcass C measurement between the 12th and 13th rib on both sides of the carcass were recorded after 24h chilling, twice by 2 operators in Experiment 1 and once by 1 operator in Exper-iment 2. The right side of each carcass in Experiment 1 and alternate right and left sides in Experiment 2 were minced 3 times and subsamples for subsequent determination of fat percentage by soxlet extraction taken.

Relationships between variables were established by simple and multiple linear regression.

RESULTS AND DISCUSSION

Experiment 1

Results from Experiment 1 show that an ultrasonic measurement on the left side of the sheep was superior to the right side measurement in predicting carcass C measurement and percentage carcass fat. Basic details (means and standard deviations of variables) of live animal and carcass measurements have been presented (Nicol and Parratt, 1984). The correlation between repeated UFD measurements was higher for the left side (left 0.80; right 0.68) with 1 operator although not different with the other (left 0.85; right 0.85). Left UFD has a significantly higher ($P<0.01$) (13%) correlation with both left and right carcass C measurement (Fig. 1) with both operators than did the right UFD. Fig. 1 includes correlations between UFD and carcass measurement C within both replicates and operators. Left UFD was better than right UFD in predicting left and right carcass C measurement. These correlations between UFD and carcass C are of the same order as those obtained in

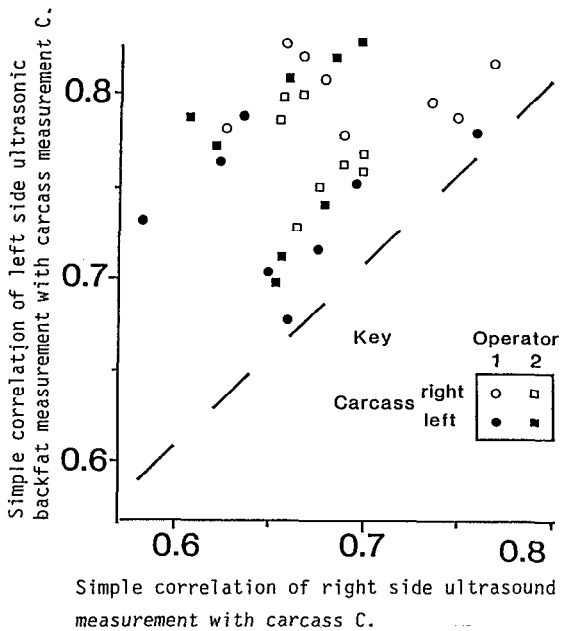

FIG. 1 Correlations between left and right ultrasonic fat depth measurements and carcass measurement C (Experiment 1).

TABLE 1 Multiple regression predicting fat free carcass weight from live weight alone and with combinations of ultrasonic fat depth measurements (Experiment 1).

Independent variables	Regression coefficients b_1	b_2	Intercept	R^2	RSD (kg)
Live weight alone	0.332 (±0.05)	-	1.53	0.605	1.49
Live weight plus					
-Repeated left UFD	0.348 (±0.044)	-0.415 (±0.122)	3.75	0.729**	1.26
-Single left UFD	0.349 (±0.045)	-0.430 (±0.137)	3.79	0.719**	1.28

Live weight plus	Mean single right + left UFD	Repeated right UFD	Single right UFD
R^2	0.698	0.691	0.676
RSD	1.33	1.35	1.38

**Significant improvement over live weight alone.

an earlier evaluation of this type of UFD probe (Purchas and Beach, 1981).

The value of an UFD is as an indicator of carcass fatness. In all comparisons, the correlation of left UFD with percentage carcass fat was higher than for right UFD and in 3 out of 4 comparisons left UFD was a better predictor of percentage carcass fat than the mean of the right and left UFD (Fig. 2). Only the mean of repeated left UFD had a higher correlation (r = 0.72) with percentage carcass fat than a single left UFD (r = 0.67).

As might be anticipated with correlations between similar variables in a data set, the higher correlations of left UFD with carcass fat percentage result in lower prediction errors of fat-free carcass weight (FFCW) and percentage carcass fat (Table 1). It was on this evidence that Nicol and Parratt (1984) used only a single left UFD for ranking 2-tooth rams on lean growth rate.

Because of the design of experiment 1 it was not possible to explain why left UFD was more useful than right UFD. Two possible explanations associated with the technique are:

(a) Left UFD was the measurement taken on the side *opposite* to the location of the operator and
(b) Left UFD was the *second* measurement taken, after the experience of taking and knowing the right measurement.

A third possibility, that there exists some basic anatomical advantage of the left side over the right, can not be completely excluded since the correlation of left carcass C measurement with percentage carcass fat was slightly higher (r = 0.77) than right carcass C (r = 0.73), but the difference in these correlation coefficients is small compared to that between right and left UFD and percentage carcass fat.

Experiment 2

The results of this experiment show that both the location of the operator relative to the UFD measurement and the sequence of the UFD measurement influences the value of an UFD for predicting carcass fatness.

Table 2 shows the mean and standard deviation of the variables measured. A within animal analysis of variance of the effect of location of operator and order of measurement on UFD showed significantly ($P<0.1$) higher left UFD when the operator was on the right (opposite) side of the animal. The same trend existed for right UFD. Order of measurement did not significantly influence UFD. Values for the correlation of UFD with carcass C measurement in Table 3 represent the mean of two values, e.g. right UFD correlation with right carcass C is the mean correlation when this comparison was the first and

TABLE 2 Mean, standard deviation and range of physical characteristics of 32 Border Leicester ram hoggets (Experiment 2).

	Mean	Standard deviation	Range
Live weight (kg)	59.7	8.0	42-75
Ultrasonic fat depth (mm)	5.65	2.75	1.0-17.0
Carcass weight (kg)	30.7	4.5	21-38.5
Carcass C (mm)	9.40	4.70	1.0-24.0
Carcass fat (%)	54.1	6.94	32.0-67.0

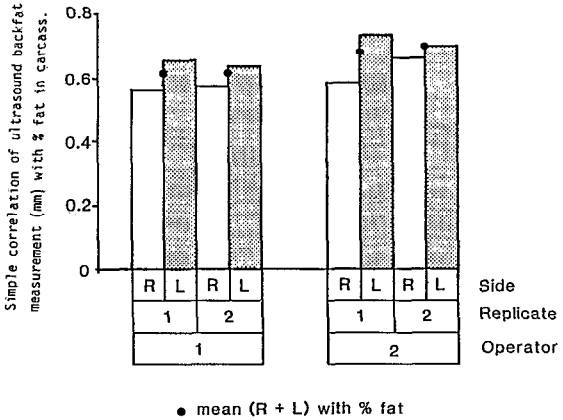

FIG. 2 The effect of operator, repeat ultrasonic backfat measurements and side of measurement on the correlation between the measurements and percentage carcass fat (Experiment 1).

TABLE 3 Effect of operator location and order of measurement on ultrasonic UFD (mm) and correlation of UFD with carcass measurement C (mm) and percentage carcass fat for the right and left side of the sheep (Experiment 2).

	Simple correlation of UFD with:					
	UFD		Carcass C measurement		Carcass fat	
	Right	Left	Right	Left	Right	Left
Operator location						
- Same side as UFD measurement	5.3_a	5.5_a	0.75	0.79	0.70	0.70
Opposite side to measurement	5.6_a	6.4_b	0.81	0.84	0.72	0.72
Order of measurement						
- First	5.2_a	5.9_a	0.76	0.79	0.73	0.66
- Second	5.6_a	5.9_a	0.81	0.84	0.72	0.74

Mean followed by different subscript significantly different ($P<0.05$).

second measurement. Correlations between UFD and carcass measurement C were consistently higher when the measurement was taken on the opposite side of the animal and with the second measurement. The advantage of opposite side UFD in predicting percentage carcass fat was consistent for both sides but the second measurement of left UFD was only superior in predicting percentage fat. In this data set, left carcass C measurement again had a slightly higher correlation with percentage carcass fat (r = 0.82) than right carcass C (r = 0.80).

The results of Experiment 2 help to explain those of Experiment 1 in which left UFD was the most satisfactory UFD. In experiment 1, left UFD was taken from the right (opposite side) of the animal and was the second measurement thus showing the additive effect of location of operator and sequence of measurement.

A possible explanation for the superiority of measurements made on the *opposite* side is that a more sensitive touch in laying the probe transducer on the animal is achieved by utilising muscles with finer motor control than those used to push the probe against the animal when taking measurements on the *same* side.

The higher correlation of the second UFD (compared with first) measurement with carcass fatness suggests that the first m8asurement gives the operator a UFD value on which he partly bases his interpretation of the second measurement.

We are convinced that improved UFD measurement can be made as a result of this work. In our hands the most effective single UFD measurement is that made on the left side of the animal with the operator located on the right side. A second measurement is a more accurate single estimate of carcass fatness but obviously cannot be taken without a first measurement! Thus if repeated measurements are required these should be made on the same (left) side.

We are aware that these conclusions apply specifically to our operator(s), both of whom are right handed and we anticipate that other operators will wish to test these conclusions for themselves before they adopt these improved simplified procedures.

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