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An evaluation of the fat-depth indicator on carcasses of pigs, cattle and sheep

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ABSTRACT

Fat depths were measured on the hot carcasses of 128 pigs, 64 steers and 106 lambs using an appropriate Fat-Depth Indicator (FDI). Corresponding linear depths were taken 4 cm (pigs), 8 cm (steers) and 3.5 cm (lambs) lateral to the dorsal midline in the region of last rib. Pig and steer carcasses were physically dissected into subcutaneous fat plus rind and trim fat respectively. Of fat depths taken on the hot carcass by FDI 72, 57 and 98% were within ±1 mm of the linear depth for pigs, steers and heavy weight lambs respectively. The FDI tended to overread corresponding linear depths of lighter weight lambs. Residual standard deviations for predicting linear fat depths from hot FDI readings were 1.53 mm and 1.4 mm for pigs and steers.

Fat content of pig carcasses predicted from a multiple regression including side weight and either the hot FDI fat depth or linear caliper depth had residual standard deviations of 2.88% and 2.35% respectively. For steers the corresponding residual standard deviations were 3.8 kg and 3.2 kg. Accuracy of predicting carcass fatness in pigs was improved by allowing intercepts to vary with 'backing down'.

INTRODUCTION

Many national carcass classification and grading systems rely on backfat measurements for predicting fatness. Recently considerable interest has been shown in automated electronic probes for measuring backfat. An example of this development is the Fat-Depth Indicator (FDI) which senses the colour change as it passes from white fat to red muscle. The depth at which this colour change occurs is displayed as a digital readout.

Preliminary evaluations of the FDI have been published for pigs (Giles, 1980; Kempster *et al.*, 1981; Pommeret *et al.*, 1981; van Miltenburg, 1981; Adam and Hargreaves, 1981). However, its accuracy or suitability for steers and lambs has not yet been established.

The trials reported were done to assess the precision of estimating cold linear fat depths from FDI readings and also the accuracy of predicting carcass fatness with pigs, cattle and sheep.

MATERIALS AND METHODS

Carcasses from 128 pigs, 64 steers and 106 lambs were examined. Thirty-two pigs were slaughtered at each of 50 and 70 kg live weight and a further 64 at 90 kg. At each slaughter weight there were equal numbers of entire males and gilts. Beef steers were slaughtered at an average live weight of 445 kg and lambs at 27 and 35 kg.

Fat depths, including skin, were measured on the right side of each pig carcass 4 cm lateral to the dorsal midline and immediately posterior to the last rib. Before measurements were taken the site was marked. Half the carcasses within each sex/weight group were 'backed down' to fully expose the dorsal vertebral spines, the remainder were left intact. For beef steers and lambs subcutaneous fat depths were taken on the left side 8 and 3.5 cm lateral to the dorsal midline at or in the region of the 13th rib respectively. All depths were taken within 45 min of slaughter.

The basic pig FDI was modified for cattle by setting base plate springs to a lower tension. For lambs an even lower spring tension was used together with a solid sharpened triangular cutting tip. The standard tip for pigs and cattle was a double-edged scalpel type.

Ater 24 h at 3°C the corresponding measurements were taken on the cut side by caliper (pigs), or ruler, to the nearest 1 mm. For steers an FDI reading was also taken on the chilled side at the same position as that used for the hot measurement.

The right side of each pig carcass was dissected into fat (skin + subcutaneous and flare fat) and lean body. For beef steers the left side was broken down into fat, meat and bone. No composition data were available for the lambs.

RESULTS AND DISCUSSION

Mostly there was good agreement between fat depth measured hot by FDI and the mean linear depth on the chilled carcass (Table 1). However, the exception was for lambs around the national average carcass weight. Equally, for steers and lambs, mean fat depths taken by FDI on the chilled carcass were considerably larger than those recorded on the hot carcass. For lambs it was observed that the type of probe used pushed subcutaneous fat down the measurement hole and into the muscle particularly at the lighter weights and lower fat covering. Consequently, fat depths by FDI on the hot carcass overread by 0.9 mm ($P < .001$) for lambs of average carcass weight (Table 2).

For pigs, steers and heavy lambs 72, 57 and 98% of fat depths taken by FDI either equalled or were within ± 1 mm of the cold linear depth (Table 2). With pigs, the unexplained variation in cold linear fat depths from the regression on hot FDI fat depth was 9.7%. The resulting residual standard deviation of ± 1.5 mm was lower than that of Kempster *et al.* (1981) but similar to that by Adam *et al.* (1982). Residual variation was not further reduced by allowing intercepts to vary with either 'backing down' or sex. For beef, the residual standard deviation of predicted linear fat depths from hot FDI depths was ± 1.4 mm. Although fat removal along with the hide was not a problem with steers in this trial, the site used is susceptible to fat removal when a hide puller is used for skinning at commercial speeds.

The accuracy of predicting carcass fatness was also estimated by regression procedures. Using side weight alone accounted for 9 and 28% of the variation in fatness in pigs and steers respectively. With pigs further variation was explained ($P < .001$) by including either the linear fat depth or hot FDI depth (Model i, Table 3). For both pigs and steers fat depths measured hot by FDI accounted for less variation in fatness than cold linear fat depths. In the case of steers there was little increase in predictive accuracy by using the cold FDI depth as opposed to the linear depth. Finally residual variation in carcass fatness was futher reduced in pigs by allowing

TABLE 1 Means and standard deviations of side weight, fat depths and carcass fat content

	Pigs		Cattle		Lambs			
					Heavy		N.Z. Average	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Side Wt (kg)	25.3	6.1	126	11.6	17.2‡	2.2	13.1‡	2.0
FDI hot (mm)	16.6	4.5	4.7	1.7	5.3	1.3	3.6	0.7
FDI cold (mm)	—	—	7.4	4.0				
Linear cold (mm)	16.2	4.8	4.8	2.3	5.2	1.6	2.7	0.9
Fat (%)	28.5	4.9	—	—				
Fat (kg)	—	—	14.0	6.0				

‡ Hot carcass weight

TABLE 2 FDI measurements on the hot carcass related to linear measurements on the chilled carcass

FDI' – Ruler (mm)	Pigs	Steers	Lambs	
			Heavy	N.Z. Average
+4		5		
+3	3	6		
+2	8	27		22
+1	21	24	37	56
0	22	30	38	15
−1	29	3	23	6
−2	9	3	2	
−3	8			
−4		2		

TABLE 3 Residual standard deviations for predicting carcass fat from different measurements

Model	Side Wt (SW)	SW + FDI (hot) (i)	(ii)	SW + FDI (cold) (i)	SW + Linear (cold) (i)	(ii)
Fat% (pigs)	4.72	2.88	2.85	—	2.35	2.31
Fat kg (steers)	5.10	3.80	—	3.0	3.20	—

Model (ii)—Separate intercept for 'backed down' carcasses intercepts to vary with 'backing down' (Model ii) before taking fat depths with either the FDI ($P < .10$) or calipers ($P < .05$).

Results from this preliminary evaluation with pigs, steers and lambs showed that fat depths taken by FDI on the hot carcass were generally in good agreement with corresponding linear depths taken on the chilled carcass. However, the accuracy of predicting carcass fatness form side weight and a single hot FDI fat depth was better for pigs than for steers.

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