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An evaluation of the Hennessey and Chong grading probe for estimating bovine carcass fat thickness

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Summary

The accuracy of the Hennessey and Chong grading probe for the slaughter floor measurement of beef carcass fat thickness at the P8 (rump) site was tested by comparing probe measurements with manual cut-and-measure measurements.

Although the Hennessey and Chong grading probe has been approved for the measurement of pig fat thickness, results of this trial indicated that, in its present form the probe is not satisfactory for the measurement of fat thickness in beef carcasses.

An equation was calculated, which may be used to re-calibrate the probe.

INTRODUCTION

Beef carcass classification, trading, grading and monitoring systems, and the requirements made of computer selling of stock all depend presently on accurate subcutaneous fat measurement. A fast, reliable and repeatable method of measurement would be of immense value.

The New Zealand Hennessey and Chong grading probe (HGP) manufactured by Hennessey and Chong Pty Ltd, Auckland, has gained acceptance as a fat measuring tool for use on pig carcasses (J. M. Beames, pers. comm. 1984). Trials at Thomas Borthwick and Sons (Australasia) Ltd Abattoir, Mackay, indicated that the HGP measured greater than actual in the low fat thickness range and less than actual in the high fat thickness range when measuring beef fat (J. Hall, pers. comm. 1983). To assess the acceptability of the HGP for the beef industry there was a need for further investigation.

A trial was conducted at the Metropolitan Regional Abattoir, Cannon Hill, Brisbane, in collaboration with the Queensland Livestock and Meat Authority who provided a HGP for the purpose. Probe measurements were compared with manually taken cut-and-measure (C&M) measurements.

MATERIALS AND METHODS

A HGP with a 95mm probe was used. The sharp pointed blade of the probe is inserted into the carcass. A light emitting diode (LED) located near its point emits light which is reflected in different intensities by the meat and fat surrounding the probe. The reflectivity signals are processed electronically to provide a direct digital readout in millimetres.

C&M was carried out with a no.22 scalpel blade on a no.4 handle to which was attached a plastic rule marked in millimetres. It gave minimal fat distortion and was easy to read accurately.

Five hundred and seventy-six carcasses were measured on the moving chain, operating under normal commercial conditions. There was no selection except that mutilated rumps or measuring sites which were bruised or contained blood were not measured. Fat over the rump proved to be firmer than alternative measuring sites investigated, that is the site over the eye muscle between the 12th and 13th ribs, the site over the muscle of the loin and the position known as the sacral crest site. Probe measurements were taken on the rump of one side only of each carcass immediately before the wash.

The probe measuring site was the rump P8 position anatomically described by Moon (pers. comm. 1980) as the intersection of a line from the dorsal tuberosity of the tripartite tuber ischii parallel with the chine and a horizontal line from the crest of the spinous process of the third sacral vertebra. The probe site was marked with erythrosine ink after measurement. One person recorded while another used the probe.

Two persons measured fat thickness manually (approximately 5 minutes after the carcass had been washed).

Measurer 1 made an incision in the fat approximately 2cm in length, down to the muscle fascia at the previously marked probe position and measured the fat thickness (C&M 1).

Measurer 2, using the same cut took a second measurement (C&M 2). Two measurers were used in this way to establish the reliability of the cut-and-measure technique. Both persons were experienced in the technique.

One person recorded both C&M measurements and ensured that the measurers did not know each other's findings. There was no rotation of personnel. All measurements were taken on hot fat in millimetres.

The data were considered first as one set, and then the data were split into fat classes on the average cut-and-measure (ACM) value, giving sets with unequal numbers. There were nine classes: 0 to 4, 5 to 9, 10 to 14, 15 to 19, 20 to 24, 25 to 29, 30 to 34, 35 to 29 and >40mm. Each class, except >40mm, contained at least 20 measurements.

Analyses involved:

1. An analysis of variance to test the difference between the C&M operators.
2. An analysis of variance to test the difference between ACM and probe measurement.
3. A regression analysis used to determine the functional relationship between Y=Probe and X=ACM.

RESULTS

Reliability of the C&M technique

Although there is a statistically significant difference in the first four classes, in practice it is probably too small to be important (<1mm), Table 1.

Table 1. Variation between operators in cut-and-measure (C&M) means by classes of fat depth in millimetres

Operator	Fat depth classes (mm)								
	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	>40
C&M 1	2.6	7.1	11.7	16.9	22.1	26.7	31.8	36.7	44.8
C&M 2	2.9	7.8	12.5	17.4	22.2	26.3	31.5	36.7	45.3
	*	**	**	**	n.s.	n.s.	n.s.	n.s.	n.s.

* Difference significant ($P<0.05$).

** Difference significant ($P<0.01$).

n.s. Difference not significant.

Accuracy of fat thickness measurement by HGP

A comparison of means between fat classes shows a significant difference over the whole range (Table 2).

Table 2. Comparison* of means by classes of fat depth probe measurement versus average cut-and-measure (ACM)

Method	Fat depth classes (mm)									Means
	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	>40	
ACM	2.7	7.5	12.2	17.2	22.1	26.5	31.6	36.7	45.0	16.6
Probe	1.7	5.3	8.6	11.7	15.0	18.6	23.1	27.5	37.1	11.6

* All means in the same column are significantly different ($P<0.01$).

The regression analysis showed a linear relationship, best expressed by the equation $y=-0.819+0.752x$ which is shown in Figure 1. The regression is a functional relationship where both the x and the y of the regression are considered to contain some error. Where Y=Probe and X=ACM the measure of variance of Y about the line is 2.6 while the corresponding estimate of variance of X is 0.67. The correlation co-efficient $r=0.97$ indicating that the equation is satisfactory for use in re-calibration.

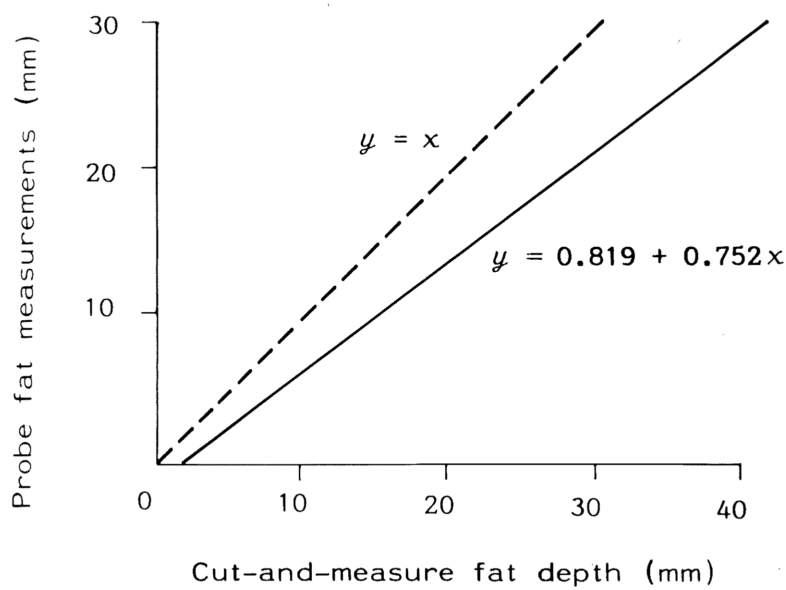

Figure 1. Relationship between HGP and ACM techniques.

DISCUSSION

Reliability of C&M techniques

Although there was an apparent trend in error within this method the differences are very small. Therefore the use of the ACM as the true fat thickness with which to compare probe measurements was justified.

Accuracy of the HGP

The comparing of means with probe against ACM shows a definite disagreement between the two with the ACM value always being higher as in Figure 1. Therefore the probe used (with its present calibration) is inaccurate and of no value for measuring bovine fat thickness. The equation $y=-0.819+0.752x$ was calculated for recalibration of the HGP to remove bias. Nevertheless even after recalibration, the HGP will be more variable than ACM with its corresponding estimate of variance approximately three times that of ACM.

The major tool for assessment of the data has been the computed graph of Y=Probe, X=ACM which showed the relationship to appear linear and the variability of the data to appear low.

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