AN EVALUATION OF RUMP P8 AND TWELFTH RIB FAT THICKNESS MEASURING SITES FOR ESTIMATING SALEABLE BEEF YIELD IN EXPORT AND LOCAL CARCASSES

E.R. Johnson[1] and B. Ball[2], [1]School of Veterinary Science, University of Queensland, St. Lucia, Qld. 4067, Australia and [2]South Burnett Meat Works Co-op. Association Ltd., Murgon, Qld. 4065, Australia.

SUMMARY

Twelfth rib and rump "P8" fat thickness predicted saleable beef yield with approximately equal accuracy in heavy (Japanese) carcasses and in lightweight (local) carcasses. The addition of hot side weight to each fat thickness measurement was of limited value in improving the prediction of saleable beef in export carcasses and the addition of carcass weight (both hot and cold) to rump "P8" fat thickness significantly, but only slightly, improved the prediction of saleable beef yield in lightweight carcasses. In each group of steers and for each fat thickness measurement the R2 was generally less than 50%, indicating that the measurements were not good predictors of saleable beef yield in similar types of carcasses.

INTRODUCTION

Since Moon (1980) first described the usefulness of the rump "P8" fat thickness measuring site as an alternative to the frequently-damaged 12th rib site (Johnson and Vidyadaran 1981), its use has spread rapidly in northern Australia particularly in the export beef trade.

Although the AUS-MEAT Committee of the Australian Meat and Live-stock Corporation chose Moon's "P8" site for use in its National Language of carcass description, the scientific evidence justifying this site for general use is limited. Johnson and Vidyadaran (1981) confirmed the usefulness of the rump site, but their study, like that of Moon's (1980), contained a large number of heavier export carcasses.

The main use of the fat thickness measurement is to estimate saleable beef yield which varies in composition depending on the specifications of the various markets. It is important, therefore, that the rump "P8" measurement, recommended for general use in the meat industry, should indicate saleable beef yield reliably for Australia's many different markets.

The following paper reports details of a comparison of rump "P8" and 12th rib fat thickness measurements in estimating saleable beef yield in heavy (export) and lightweight (local) carcasses.

MATERIALS AND METHODS

Two groups of carcasses were studied, the first, 60 heavy steers consigned to a south-east Queensland abattoir for the Japanese grass-fed, chilled beef market. These animals were slaughtered, dressed, divided into sides and weighed. After chilling at 3°C each side was divided into 12 primal cuts (according to specifications of the Japanese Livestock Industry Promotion Corporation) and manufacturing meats (according to specifications of the U.S.A. Department of Agriculture) by an experienced industry employee. A second group of 40 steer carcasses was prepared for the local (Sydney) market at a northern New South Wales abattoir. Details of both groups of carcasses are given in thickness measurements were recorded. Twelfth rib fat thickness (Murphey et al. 1960) was taken mid-way between the 12th and 13th ribs, three-quarters of the distance from the medial to the lateral edge of *m. longissimus thoracis et lumborum*. Rump "P8" fat thickness (Moon 1980) was taken at the point of intersection of two lines, one passing from the dorsal tuberosity of the tuber ischii parallel to the spinal column, the other passing at right angles to the

Table 1. Details of steer carcasses in which yield predictions of twelfth rib and rump "P8" fat thickness measurements were studied

Genotype [A]	Number	Hot carcass weight (kg)	Fat thickness [B] 12th rib (mm)	rump "P8" (mm)	Saleable beef yield [C] (%)
Hereford	15	312-318 (353.7)	9-25 (14.0)	8-30 (16.6)	58.1 -68.9 (64.5)
Brahman	15	299-343 (318.6)	2-14 (6.9)	6-20 (10.7)	67.0-74.3 (71.8)
Brahman x Hereford	15	368-389 (378.8)	4-16 (9.2)	6-22 (13.8)	69.0-73.6 (71.5)
Simmental x Hereford	15	297-388 (337.9)	3-9 (4.6)	3-13 (6.1)	69.2 -73.8 (71.5)
Hereford	40	173-235 (208.1)	2-10 (3.9)	3-13 (6.6)	68.8 -72.6 (70.5)

Values in parenthesis are means

[A] Sixty carcasses were prepared for the Japanese market; remaining 40 lighter Hereford steers were prepared for the local market

[B] Fat thickness measurements (defined in MATERIALS AND METHODS) were made on chilled carcasses

[C] The weight of 12 primal cuts plus manufacturing meats (specified by Japanese and U.S.A. importers) expressed as a percentage of chilled side weight in the 60 heavier carcasses; the weight of ten primal cuts plus manufacturing meats (local market requirements) expressed as a percentage of chilled side weight in the 40 lighter carcasses

TABLE 2. Predictions of percentage saleable beef yield from 12th rib and rump "P8" fat thickness measurements

Saleable beef yield (%) of group[A]	Independent variables[B] b1 (mm)	b2 (kg)	Regression coefficients intercept	b1	b2	Residual standard deviation (%)	R^2 (percentage variance accounted for)
Export steers							
Hereford	FT_{12}		71.2	-0.44**		2.32	36
Brahman			74.1	-0.39*		1.53	74
Bra. x Her.			74.1	-0.28*		1.83	30
Simm. x Her.			71.2	0.09[NS]		1.50	9
Breed-ignored			74.7	-0.55**		2.41	58
Hereford			69.7				
Brahman			74.2	-0.34**		1.79	78
Bra. x Her.			74.6				
Simm. x Her.			73.1				
Hereford	P8		71.3	-0.40**		2.17	46
Brahman			74.6	-0.26**		1.44	74
Bra. x Her.			74.2	-0.20*		1.85	46
Simm. x Her.			69.8	0.29[NS]		1.00	43
Breed-ignored			74.3	-0.37**		2.94	37
Local Hereford steers							
	FT_{12}		71.1	-0.15*		0.78	12
	FT_{12}	HCW[NS]	-	-		-	-
	FT_{12}	CCW[NS]	-	-		-	-
	P8		71.6	-0.17**		0.72	24
	P8	HCW	68.4	-0.24**	0.02**	0.66	39
	P8	CCW	68.7	-0.24**	0.02**	0.67	37

[A] Sixty export steer carcasses (made up of 15 each of Hereford, Brahman, Brahman x Hereford and Simmental x Hereford) and 40 "local" Hereford steer carcasses

[B] FT_{12} fat thickness at the 12th rib; P8, fat thickness at the rump; HCW, hot carcass weight; CCW, cold carcass weight. When hot side weight was added to 12th rib fat thickness and to P8 fat thickness in the export steers, the RSD of the yield prediction was significantly reduced ($p < 0.01$) in the Herefords, in each case, but not in the other three genotypes

[C] In the regression, yield of saleable beef on 12th rib fat thickness in the four groups of steers, there were significant differences ($p < 0.001$) among intercepts but not among slopes so data are given for the common slope

* $p < 0.05$; ** $p < 0.01$; [NS] Not significant

first from the crest of the spinous process of the third sacral vertebra.

In each study all boning room products including prepared cuts, manufacturing meats and waste trims were weighed prior to packing or discarding, allowing the saleable beef yield (cuts plus manufacturing trims) for each market to be calculated.

The prediction of saleable beef yield from 12th rib and rump "P8" fat thickness measurements was examined by simple and multiple linear regression. In the latter case side weight or carcass weight was used as the second regressor. All regression analyses were examined for curvilinear relationships using quadratic analysis.

RESULTS AND DISCUSSION

The abilities of 12th rib and rump "P8" fat thickness measurements to predict yield of saleable beef are shown in Table 2.

Export steers

In the heavier steers for which regression equations are shown for each of the four genotypes, the residual standard deviations (RSD), were very similar for each measurement, indicating that 12th rib and rump "P8" fat thickness predicted yield with about the same degree of accuracy. The breed-ignored equations are shown in this study because in the meat processing industry, carcass yield is implied from carcass measurements which do not take into account genotype. Data in Table 2 therefore, give an indication of the improvement in accuracy that would result if genotype were added to the AUS-MEAT system which currently classifies carcasses on the basis of a fat thickness measurement and carcass weight. It may well be concluded that the improvement in accuracy of prediction of saleable beef yield does not justify the inclusion of genotype in commercial circumstances. The fact that yields in this study varied significantly with genotype is consistent with the results of Ball and Johnson (1987 unpublished data) who, in a commercial boning room study found that yield of saleable beef for the Japanese market was influenced by breed and sex.

When the yields from 12th rib fat thickness and rump "P8" fat thickness were calculated on a breed-ignored basis (both, $p < 0.01$) the RSD's, though much higher than for individual genotypes, remained similar (2.4% and 2.9% respectively), suggesting again similar usefulness of the two measurements.

The addition of hot side weight to each fat thickness measurement (not shown in Table 2) was of limited value. It did not significantly improve yield prediction in the Brahman, Brahman x Hereford and Simmental x Hereford groups; however a significant (p 0.01) negative regression occurred with hot side weight in the Hereford carcasses, in the case of each fat thickness measurement.

Twelfth rib fat thickness accounted for a relatively low percentage of the variance in estimated yield of saleable beef (9% to 74%), a finding that could have been influenced by variation in the composition of saleable beef yield. Anatomical dissection, however, showed that while saleable beef yield of the Simmental x Hereford group had a significantly lower proportion of subcutaneous fat than the other three genotypes, and saleable beef yield of the Herefords, a significantly

greater proportion of intermuscular fa than the other genotypes, the variation was not great. Total fatness of yield was 11.9% for the Herefords, 10.6% for the Brahmans, 11.1% for the Brahman x Hereford steers and 9.5% for the Simmental x Hereford group. The use of rump "P8" fat thickness accounted for a greater percentage of yield variance (43% to 74%) and in a more consistent manner among the genotypes. The data show that whilst 12th rib fat thickness and rump "P8" fat thickness are of approximately equal accuracy in estimating saleable beef yield, the R^2, in similar types of carcasses, is not high.

Local steers

Twelfth rib and rump "P8" fat thickness predicted percentage yield of saleable beef with similar RSD's indicating that both measurements were of approximately equal value in estimating this commercial parameter in lightweight carcasses. The rump "P8" measurement did show some small advantages over the 12th rib measurement. It accounted for a greater proportion of the variance associated with yield prediction, and both hot carcass weight and cold carcass weight, added to rump "P8" fat thickness, significantly but slightly, improved the prediction of yield. Perhaps of more importance is the fact that the fat thickness measurements accounted for less than 40% of variance indicating, once again, that they were poor predictors of saleable beef yield in carcasses of similar composition.

Quadratic analysis of regressions of percentage saleable beef yield on each of the fat thickness measurements did not significantly improve the accuracy of prediction in either the export or the local carcasses.

CONCLUSION

Twelfth rib and rump "P8" fat thickness measurements are of equal accuracy in predicting percentage yield of saleable beef in heavy export carcasses (297-389 kg) and in lighter local weight carcasses (173-235 kg). In each group, which consisted of similar carcasses, the fat thickness measurements were relatively poor predictors of saleable beef yield.

ACKNOWLEDGEMENTS

This study was funded by grants from the Australian Meat and Live-stock Research and Development Corporation and the Australian Meat and Live-stock Corporation. We thank the management and staff of the Northern o-operative Meat Company Limited, Casino, N.S.W. for their assistance. Dr. D.C. Chant, Social Sciences Group, University of Queensland provided statistical advice.

REFERENCES

Johnson, E.R. and Vidyadaran, M.K. (1981). *Aust. J. Agric. Res.* **32**:999.

Moon, J.B. (1980). Promotional thesis, Slaughtering and Meat Inspection Branch, Department of Primary Industries, Brisbane. Australia.

Murphey, C.E., Hallett, D.K., Tyler, W.E. and Pierce, J.C. Jr. (1960). *J. Anim. Sci.* **19**:1240 (Abstr).