The Use of Saleable Beef Yield as a Scientific Parameter

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SUMMARY: In sixty beef carcases ranging from 297 to 395 kg hot carcass weight, the anatomical components of saleable beef yield (cuts plus manufacturing meat) were determined by total dissection. As subcutaneous fat thickness increased, the fat content of saleable beef yield rose from 11.0% to 24.4%. While saleable beef yield varied with genotype the differences could not be explained by degree of fat trim. Hereford steers with the lowest saleable beef yield at any given subcutaneous fat thickness contained the highest levels of dissectible fat. Although the meat trimmer prepared cuts and manufacturing meat to a given specification the proportion of fat in saleable beef yield increased linearly with increasing fat thickness regardless of genotype. There was no tendency for any slope to plateau. The findings show that scientists should be very cautious in interpreting carcass growth responses when they use saleable beef yield as the dependent variable.

INTRODUCTION:

Saleable beef yield, by definition, has always been an important trading parameter for the meat exporter or the retail butcher. It is fundamental to profits. Over recent years however, scientists have come to use saleable beef yield as the "y" (or dependent) variable in studies of the growth of cattle or their carcases. The use of saleable beef yield to interpret growth patterns, nutritional treatments or genetic differences is now widespread. Since saleable beef yield is, anatomically, a poorly defined parameter which varies in interpretation between and within markets, its use as the dependent variable in many scientific investigations seems highly questionable. The reliability of saleable beef yield, commercially derived, in scientific studies may be further compromised by commercial motives.

In order to investigate the validity of saleable beef yield as a scientific parameter, the study reported in this paper was conducted with the emphasis on close adherence to cutting and trimming specifications.

MATERIALS and METHODS:

Sixty sides of beef from steers grass fed for the Japanese chilled beef market were studied. Details of the carcases (15 each of four genotypes) are shown in Table 1.

From the right side of each of the carcases 12 commercial cuts and manufacturing meats were prepared according to specifications defined by the Livestock Industry Promotion Corporation of Japan for grass-fed chilled beef. Particular effort was made to adhere to these specifications and one boner and one trimmer only were used in the treatment of the 60 sides. Saleable beef yield comprised the commercial cuts plus manufacturing meats. In order to determine the anatomical composition of saleable beef yield, all 12 commercial cuts together with the manufacturing meats were totally dissected into muscle, bone, fat and connective tissue. Regression analyses were used to study changes in commercial and anatomical composition with changing rump P8 fat thickness.

RESULTS:

Table 2 shows that the fatter carcases, generally, contained a greater percentage of fat in their saleable beef yield. The ranges of these fat percentages however, were very similar despite the wide range in carcase fatness between genotypes.

Figure 1 shows that the regressions of saleable been yield on rump P8 fat thickness did not differ significantly among Hereford, Brahman or Brahman x Hereford groups with respect to slope; the Simmental x Hereford cattle varied significantly ($p < 0.01$) in slope from each of the other three breed groups.

Table 1. Description of the carcases of steers, grass fed for the Japanese chilled beef market (Means shown in parenthesis)

Genotype	Hot carcase wt. (kg)	Rump P8 fat thickness* (mm)	Saleable beef yield† (%)	Mean carcase composition (%)		
				Muscle	Bone	Fat
Hereford	316-395	8-30	58.1-68.8			
(n=15)	(357)	(16.6)	(64.7)	54.8	13.2	30.4
Brahman	299-350	6-20	66.8-74.1			
(n=15)	(320)	(10.7)	(71.8)	62.9	14.6	20.8
Brahman x Hereford	368-393	6-22	69.0-75.3			
(n=15)	(381)	(13.8)	(71.5)	61.8	13.3	23.5
Simmental x Hereford	297-388	3-13	69.1-73.8			
(n=15)	(338)	(6.1)	(71.5)	63.3	15.9	18.9

† The weight of commercial cuts plus manufacturing meat expressed as a percentage of chilled carcase weight. Mean saleable beef yield lower in Herefords ($p < 0.01$) than in other three genotypes

* Rump P8 fat thickness described by Moon (1980)

Table 2. Total fat percentage of saleable beef yield

Genotype	Total dissected fat of carcase (%)		Total fat (%) of saleable beef yield	
	Range	Mean	Range	Mean
Hereford	20.3-40.6	30.4	14.9-24.4	20.2
Brahman	17.3-28.3	20.8	13.2-22.5	16.2
Brahman x Hereford	16.5-28.3	23.5	12.7-21.5	17.2
Simmental x Hereford	14.8-25.5	18.9	11.0-20.3	15.0

The intercept for the Herefords differed significantly ($p < 0.001$) from those of the Brahman and Brahman x Hereford groups, but the intercepts of the Brahman and Brahman x Hereford cattle did not differ. The regression lines for Hereford, Brahman and Brahman x Hereford can be considered as parallel, the lines for the last-mentioned two being coincident. Over the common range of fat thickness (8 to 13 mm), the mean responses (i.e. the ordinates of the regression lines) for percentage fat thickness did not differ significantly between Brahman, Brahman x Hereford and Simmental x Hereford cattle, but they did ($p < 0.001$) between Hereford and Simmental x Hereford breed groups.

Figure 1. Change in percentage saleable beef yield with increasing rump P8 fat thickness

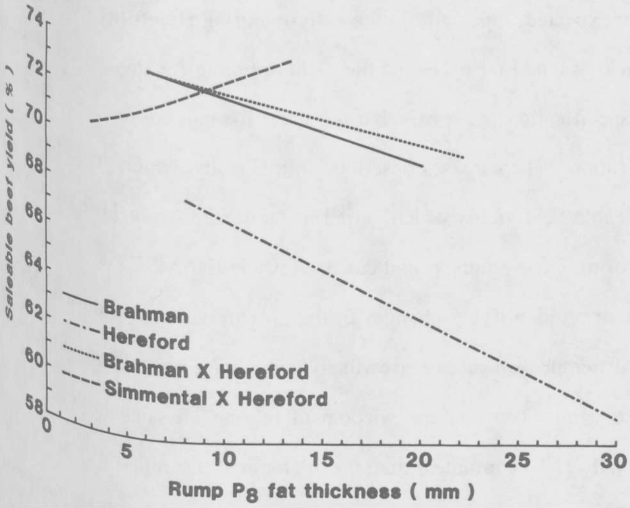
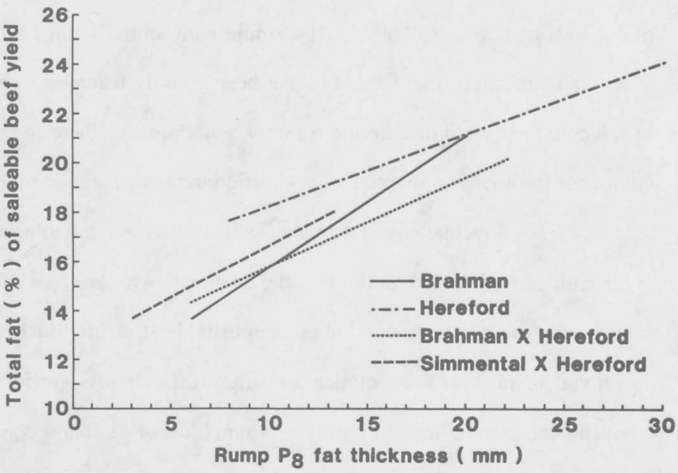


Figure 2. Change in the total dissected fat percentage of saleable beef yield with increasing rump P8 fat thickness



None of the slopes in Figure 1 or Figure 2 showed any evidence of curvi-linearity.

Figure 2 shows that the regression lines for total fat percentage of saleable beef yield on rump P8 fat thickness did not differ significantly in slope among genotypes. The intercept for the Herefords differed ($p< 0.01$) from that of the Brahman x Hereford group. No other intercept or ordinate differences were found.

DISCUSSION:

Saleable beef yield may be determined by the commercial breakdown of a carcase and the weighing of its resultant parts, or by prediction, using a subcutaneous fat thickness measurement and carcase weight. A number of scientists including MURPHEY *et al*. (1960), BRUNGARDT and BRAY (1963) demonstrated the usefulness of the relationship between 12th rib fat thickness and beef yield (cutability) for commercial carcase description. Many countries, including the U.S.A. and Australia, now use a subcutaneous fat thickness measurement to estimate "yield" in commercial carcase description. Although saleable beef yield is an important commercial parameter it should be used cautiously by animal scientists (whether determined by carcase breakdown or by using a fat thickness measurement) when used as a scientific parameter.

In the current study where saleable beef yield was obtained by carcase breakdown and trimming, with careful attention to specifications, significant genotypic differences were found at constant fat thickness. These involved differences in both the regression slopes and intercepts. The differences in intercepts between the Herefords and the Brahmans, and between the Herefords and Brahman x Hereford cattle, probably reflect simple maturity differences in fat deposition patterns such as these described by MUKHOTY and BERG (1971). If this is true and the fat deposition patterns relative to fat-free carcase weight could be defined, intercepts might be simply corrected for maturity type. However the situation with the Simmental x Hereford cattle was quite different. They differed in regression slope from the other three breeds. With low fatness levels at heavy carcase weights the muscle proportion of saleable beef yield did not decline in this late-maturing type as it did in the other three genotypes. This indicates the difficulty encountered in comparing the saleable beef yield of widely different maturity types which, in practice, are often compared at equal carcase weights.

It should be noted that although the Herefords' saleable beef yield was significantly lower than that of the other three genotypes (6.8% to 7.1%) the difference could not be explained by the degree of fat trim. In fact the Herefords had a greater percentage of total fat in their saleable beef yield (3.0% to 5.2%) and if they had been trimmed to the same extent as the other groups, their saleable beef yield would have been even lower. Because the regression coefficients did not vary in Figure 2, fat was being left in saleable beef yield at about the same rate in all four genotypes, with no evidence of curvi-linearity. While one can understand the lack of curvi-linearity in the late-maturing, low-fat Simmental x Hereford group, a plateau in the others might have been expected, especially in the early-maturing Herefords which reached high levels of fatness (40.6%). This group, with up to 30mm P8 fat thickness, had far exceeded the yield optimum for this market (attained at about 13 to 15mm) and should have been heavily trimmed to meet specification. It seems that the fatter the carcase the more fat is left in saleable beef yield despite the trimmer's attempt to adhere to specification. The carcases described in this study, which might have been compared in other commercial or scientific circumstances, involved saleable beef yields which varied in fat content from 11.0 to 24.4%.

Subcutaneous fat thickness is a relatively reliable indicator of carcase fatness and carcase muscle (RAMSEY *et al.*, 1962). It is difficult to understand therefore, why scientists who are basically intent on identifying changes in the growth patterns of muscle and fat would study the relatively unreliable composite, beef yield. Since small differences in carcase growth and composition resulting from genetic, nutritional or management studies are often difficult to identify, workers must consider the wisdom of relying on saleable beef yield in scientific carcase studies. Certainly it is much faster to obtain commercially (10-15 minutes) than the anatomical dissection of a side (50-70 hours) but WILLIAMS (1976) warned that "techniques adopted must be sufficiently accurate to detect the kind of differences which might arise as a consequence of the experimental treatments". Because of the large variation in composition of saleable beef yield within a fatness "category" in Australian abattoirs WHAN and JOHNSON (1990) advocated payment to producers according to estimated lean meat yield.

CONCLUSIONS:

Because of variations in saleable beef yield and total fat percentage of saleable beef yield amongst genotypes at constant fat thickness, it is concluded that saleable beef yield is of dubious value in many growth studies. It is recommended that total anatomical dissection be used in scientific studies of carcase growth. Where this is not possible, accurate fat thickness measurements should be used to predict total fat and total muscle of the carcase rather than the widely-varying composite, beef yield.

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