THE VALIDITY OF USING SALEABLE BEEF YIELD IN THE SCIENTIFIC ASSESSMENT OF CARCASS MERIT

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SUMMARY

The composition of saleable beef yield (13 cuts plus manufacturing meat) was studied in 42 steer carcasses weighing from 98.8 to 248.0 kg and with a P8 fat thickness ranging from 0 to 10 mm. The fat content of saleable beef yield increased with P8 fat thickness and comprised almost twice as much intermuscular as subcutaneous fat. The increase in the proportion of fat in saleable beef yield resulted from the relatively modest trimming of the intermuscular depots of manufacturing meat, point-end brisket and navel-end brisket, and the subcutaneous depots of topside and blade. The subcutaneous depots of silverside, rump, striploin and thick flank were of lesser importance. The trimming technique for rib set, chuck *roll,* shin, shank and fillet did little to contribute to increased fat percentage in saleable beef yield.

Because total fat varied by 5 .75% in saleable beef yield, the legitimacy of using this commercial character as a 'y' parameter in the scientific study of variables in cattle *or* carcasses is seriously questioned.

INTRODUCTION

The yield of 'saleable beef', which consists of muscle (lean) and fat, is a commercially important character in the marketing of beef. Over the last 30 years meat scientists have increasingly used 'saleable beef' (edible portion, cutability, commercial yield) to evaluate animal growth responses and carcass developmental changes. For example 'saleable meat' was used to investigate nutritional responses in cattle (Levy *et al.* 1971; Morgan 1972), 'edible portion' to study sex effects (Turton 1962; Garcia-de-Siles *et al.* 1977) and 'yield of trimmed cuts' to measure the influence of conformation (Fredeen *et al.* 1974; Riordan and Mellon 1978).

Recently, scientists who anatomically dissected the commercial cuts, manufacturing meat and waste trims of sides of beef found that carcass measurements (12th rib fat thickness, rump fat thickness and carcass weight) were poorly related to saleable beef yield (Johnson 1987; Ball and Johnson 1988; Johnson and Ball 1988). The same carcass measurements were, however, closely related to percentage carcass muscle and percentage carcass fat (Johnson *et al.* 1990; Taylor *et al.* 1990). The question arises whether 'saleable beef yield' is a satisfactory 'y' scientific parameter (dependent variable) for measuring the response to independent variables studied in the live animal or carcass. This paper reports on the validity of using 'saleable beef yield' as a dependent variable in scientific studies.

MATERIALS AND METHODS

Forty-two steers (14 each of Hereford, Brahman and Brahman X Hereford F2) were grown to predetermined weights. They were slaughtered at the University of Queensland's Gatton College, dressed, separated into sides and chilled at 2°C.

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Rump P8 fat thickness (Moon 1980) and carcass weight were recorded *on* the hot and chilled carcasses. After 24-48 hours the right side of each carcass was divided into 13 untrimmed boneless cuts from which 13 trimmed boneless cuts and a manufacturing meat trim were prepared. These have been described by Johnson and Charles (1981). In the current study the ten-rib brisket was divided into a five-rib point-end brisket and a five-rib navel-end brisket for closer study. The cuts were trimmed to a maximum of 8 mm fat *cover* and manufacturing meat was trimmed to a minimum of 85% visual lean. The cuts and manufacturing meat constituted saleable beef yield.

All the products of the side (cuts, manufacturing meat and waste trims) were dissected into their anatomical components, muscle, bone, subcutaneous fat, intermuscular fat and connective tissue. Regression analysis was used to identify changes in anatomical components of saleable beef yield, fat trim and individual cuts with increasing P8 fat thickness.

RESULTS AND DISCUSSION

Table 1 Relationship between P8 fat thickness and percentage muscle, subcutaneous, intermuscular and total fat in boneless cuts (untrimmed and trimmed) and fat trim

Dependent variable (% of boneless untrimmed cuts)	Mean (%)	Regression analysis			
		Intercept	b	r.s.d.	r^2
Boneless Untrimmed [A]					
Muscle	80.91	85.64	-1.228***	1.57	0.82
Subcutaneous fat	6.35	3.78	0.666***	1.10	0.73
Intermuscular fat	10.70	8.36	0.608***	1.41	0.58
Total fat	17.05	12.14	1.273***	1.67	0.81
Boneless Trimmed [B]					
Muscle	80.16	85.04	-1.264***	1.63	0.82
Subcutaneous fat	3.25	2.18	0.278***	0.63	0.59
Intermuscular fat	5.34	4.50	0.219***	0.69	0.43
Total fat	8.59	6.68	0.497***	0.95	0.67
Fat Trim [C]					
Subcutaneous fat	3.10	1.60	0.388***	0.68	0.71
Intermuscular fat	5.36	3.86	0.389***	0.99	0.54
Total fat	8.46	5.46	0.777***	1.25	0.74

[A] The carcass with bone commercially removed to produce 13 crude cuts
[B] The 13 crude cuts trimmed to specification to produce a saleable beef yield consisting of 13 trimmed cuts (maximum fat cover 8 mm) and a manufacturing meat trim (minimum visual lean 85%)
[C] Removed from boneless untrimmed product
*** $P < 0.001$

Table 1 shows how the subcutaneous (SC) and intermuscular (IM) fat depots accumulated in the carcass before trimming (normal growth) and after trimming to specification for the local market. In the boneless untrimmed cuts there was approximately twice as much IM as SC fat, and both depots *grew* at about the same rate (SC, b=0.666; IM, b=0.608) from 0 to 10 mm P8 fat thickness. Trimming to specification removed half the total fat (17.05% to 8.59%) with about-twice as much IM fat being removed as SC fat. That is, the two fat depots *were* trimmed in proportion to their original distribution in the boneless untrimmed cuts and they were trimmed at the same rate (b=0.388, b=0.389 respectively). The fact that the IM fat in trimmed cuts was about twice that of SC fat highlights a problem inherent to trimming procedures in which the IM fat depot cannot always be closely trimmed for fear of damaging the integrity of the primal cut. Therefore during increasing fat deposition the disparity between IM and SC fat depots remains in trimmed primal cuts.

Using regression data from Table 1 the predicted range in total fat percentage of saleable beef yield, from 0 to 10 mm P8 fat thickness, was 4.97 (6.68-11.65) while over the preferred fatness span in south-east Queensland (4-10 mm) the range was 2.98 (8.67-11.65). In terms of absolute data the ranges were 5.75% and 4.06% respectively. These levels are likely to be substantially lower than those encountered in normal commercial circumstances. A wide variation in the fat content of saleable beef yield may be perfectly acceptable in commercial beef trading, especially in carcasses below the specified maximum P8 fat thickness. However, when saleable beef yield is used as a 'y' parameter in scientific studies of growth and development the validity of any findings must be seriously questioned.

Table 2 Relationship between P8 fat thickness and percentage subcutaneous (SC), intermuscular (IM) and total fat in individual trimmed cuts

Cut	Cut weight distribution [A] (%)	Total fat: Intercept	b	r.s.d.	r^2	% [B]	b of SC	b of IM
N.E. brisket [C]	3.9	16.71	1.58***	3.59	59	9.1	0.11n.s.	1.47***
Striploin	5.1	5.48	1.35***	1.75	82	5.5	1.14***	0.20***
Rump	6.3	4.33	0.91***	1.13	83	5.7	0.72***	0.18**
Blade	11.4	4.91	0.77***	1.43	69	9.2	0.58***	0.19**
P.E. brisket [C]	4.1	21.00	0.75*	5.50	12	10.5	0.30n.s.	0.45*
Topside	10.4	7.54	0.74***	2.11	48	11.2	0.59***	0.15*
Silverside	8.6	4.84	0.74***	1.94	52	6.8	0.67***	0.07*
Rib set	3.8	8.54	0.60***	2.60	28	4.2	-0.03n.s.	0.63***
Thick flank	6.3	6.33	0.42***	1.97	26	5.2	0.40***	0.03n.s.
Chuck roll	4.0	5.29	0.36***	1.35	34	2.8	0.01n.s.	0.35***
Manufacturing	25.1	7.85	0.29*	1.96	14	23.6	-0.01n.s.	0.30**
Shin	3.7	6.25	0.18n.s.	2.07	5	2.8	-0.09n.s.	0.28***
Shank	4.9	3.48	0.12*	0.83	13	2.1	0.01n.s.	0.11*
Fillet	2.4	4.59	0.10n.s.	1.36	4	1.3	-	0.10n.s.

[A] Includes manufacturing trim [B] Percentage total fat distribution
[C] Briskets; N.E. Navel-end; P.E. Point-end
* P<0.05 ** P<0.01 *** P<0.001 n.s. not significant

Whereas Table 1 showed the relative effects on the fat depots of trimming crude cuts to specification, Table 2 shows the relative importance of the cuts in the trimming procedure. A positive relationship occurred between cuts percentage (including manufacturing trim) and percentage total fat for all cuts, as predicted by P8 fat thickness. Therefore the proportion of fat in all cuts increased in spite of trimming. Total fat percentage *of* saleable beef yield however, was dependent on cut weight distribution, intercept and regression coefficient. There appeared to be a strong tendency by the *trimmer* to be influenced by the fatness of the cuts. The greatest contribution to the increase in total fat in saleable beef yield could be attributed to the IM depots of three cuts, manufacturing meat, point-end brisket and navel-end brisket (43.2% of total fat) and *to* the SC depots of topside and blade (20.4%). The SC depots of silverside, rump, striploin and thick flank were of lesser importance. Rib set, chuck roll, shin, shank and fillet were relatively unimportant contributors to the increase in fatness of saleable beef yield with increasing carcass fatness.

It may be concluded that as carcass fatness increases, an increasing proportion of fat finds its way into saleable beef yield and this may be attributed mainly to a failure to trim adequately the IM depots of manufacturing meat, point-end brisket and navel-end brisket, and the SC depots of topside and blade, Since the total fat content of saleable beef yield can vary by up to 5.75% as P8 increases from 0 to 10 mm, saleable beef yield should not be used as a dependent variable in scientific studies of carcass growth.

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