Comparison of well and poorly muscled lamb carcasses as selected by experienced meat industry personnel

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ABSTRACT

Experienced meat industry personnel selected lamb carcasses categorised as either well muscled, average muscled or poorly muscled, so that a more objective specification of the carcasses meeting these different descriptions might be made. Well muscled carcasses were found at the blocky (E) end and poorly muscled carcasses toward the middle (Av) of the MLC conformation scale. Poorly muscled carcasses had the longest F, T, cut-leg length, carcass length and *M. longissimus dorsi* length measurements when compared at similar weights with the other muscling classes. Well muscled carcasses tended to have the highest fat percentage and lowest bone content. There was no difference in muscle content between carcasses of the different muscling types. This inability to recognise muscle content in lamb carcasses may explain the absence of a premium from the meat industry for carcasses with a higher muscle content despite consumer research suggesting that more muscle and less fat is required.

Keywords Lamb carcass; muscling; conformation; grades; fat; muscle; bone; length measurements

INTRODUCTION

A recent ARC Meat Research Institute survey indicated that 50% of British consumers leave all fat on the plate when eating lamb (Wood, 1982). This highlights the importance of producing lamb carcasses with a high muscle content and little fat. At meetings of a New Zealand working party on over-fatness in sheep, involving scientists from throughout the country and some industrial people, it became apparent that the term 'muscling' meant different things to different people. Experienced supervising meat graders from the Meat Producers Board agreed to select carcasses of 3 muscling categories for analysis and measurement so that the industrial use of the term muscling could be defined.

MATERIALS AND METHODS

Carcass Selection

In Trial 1, graders were asked to select from carcasses of moderate to heavy (P) fat cover (export grading symbols are explained in Kirton, 1982) 4 sets, each containing a well muscled, an average muscled and a poorly muscled carcass of similar weight.

Because the graders had difficulty in finding poorly muscled carcasses with a P fat cover, they asked to be able to select 5 examples of poorly muscled carcasses ignoring fat cover (Trial 2b). In addition (Trial 2a) they selected carcasses in sets as in Trial 1, but ignoring fat cover. One set was obtained in each of the L, M and H weight ranges (Kirton, 1982).

Measurements

Carcasses were assessed on a 6-point British Meat and Livestock Commission (MLC) conformation scale (E, Av+, Av, Av-, C and Z where E is blockiest and Z is leggiest; Cuthbertson and Harrington, 1976). Overall length was measured from gambrels to neck as defined by Moxham and Brownlie (1976) and leg length (F) and tibia tarsus length (T) as defined by Palsson (1939). Cut leg length was measured after the leg was removed by a bandsaw cut between the penultimate and last lumbar vertebra. After sectioning the left side between the last thoracic and first lumbar vertebra, A, B and C (Palsson, 1939) were measured as well as *M. longissimus dorsi* (LD) area from a tracing. GR was also measured by ruler over the 12th rib 11 cm from the midline on the chilled side which was then chopped, minced and sampled for chemical analysis using a method similar to that described by Kirton *et al.* (1962). The right side of each carcass was dissected by knife into subcutaneous fat, intermuscular fat, muscle, bone and waste and the length of the LD muscle was measured.

Biometrics

Least squares analysis was applied to the combined data, testing for muscling groups, trial (distinguishing 2a and 2b), covariance with carcass weight, and all first-order interactions.

RESULTS AND DISCUSSION

Mean carcass weights, export and MLC conformation

TABLE 1 Mean carcass weights, export carcass grades and MLC conformation grades.

Trial	No. carcasses	Good muscling Export grade	Good muscling MLC conform.	Average muscling Export grade	Average muscling MLC conform.	Poor muscling Export grade	Poor muscling MLC conform.
1	12	1 PL		1 PL		1 PL	3 Av
	4/type	3 PM	4 E	3 PM	4 Av+	3 PM	1 Av-
	Mean wt (kg)	13.4		13.4		13.1	
2a	9	1 PL		1 YL		1 YL	
	3/type	1 PM	3 E	1 YM	2 Av+	1 YM	3 Av-
		1 PX		1 PX	1 Av	1 PH*	
	Mean wt (kg)	15.2		14.5		14.0	
2b	5					4 YL	2 Av
						1 YM	2 Av-
							1 C
	Mean wt (kg)					12.0	

* Placed in the PH grade not because of the high fat cover which is normally the case but because of the excessively leggy nature of the carcass.

grades are given in Table 1. The graders experienced great difficulty in finding poorly muscled carcasses with a moderate fat cover. This suggests that fatness is one of the factors contributing to a visual assessment of better muscling. The graders took almost an hour at a large export works to select the 5 poorly muscled carcasses of Trial 2b. It took about a week to find the heaviest poorly muscled carcass in Trial 2a. These difficulties in locating poorly muscled carcasses indicate that those chosen for the present trial are not common. When fat cover was ignored all well muscled carcasses had a P (moderate to heavy) fat cover whereas the average and poorly muscled carcasses had a Y (light) fat cover at the L and M weights.

The MLC conformation scale clearly separates the carcasses into groups matching the muscling classification; all the well muscled carcasses fell into the blockiest (E is regarded as best) conformation grade. The average muscling carcasses mainly fell in the Av+ conformation class while the poorly muscled carcasses ranged from Av to C on the poorer end of the MLC conformation scale (Cuthbertson and Harrington, 1976).

Both trials showed the same pattern of muscling group differences, although, as could be expected from the fat cover restriction involved in Trial 1, differences were smaller there for composition and measurement variates associated with fatness. This interaction also occurred for percent bone and muscle/bone ratio. Most variates were related (within trial and muscling group) to carcass weight and overall averages are presented in Table 2 for values estimated at 13.0 kg cold carcass weight.

Mean measurements and composition data are given in Table 2. The well muscled carcasses had the shortest F, T, cut-leg, carcass and LD length measurements with the poorly muscled carcasses having the greatest length measurements. These results, together with conformation assessment based on the MLC scale show that factors that industry personnel now consider as indicators of carcass muscling have much in common with those that were considered to be indicators of carcass conformation (see Kirton and Pickering, 1967).

The poorly muscled carcasses had shallower LD muscles (measurement B) with smaller cross sectional areas than the well muscled carcasses. These results agree with Butterfield's (1965) suggestion that LD

TABLE 2 Mean measurements and composition of carcasses at 13.0 kg cold weight.

Item	Muscling class Good	Average	Poor	RSD	Sig.
% muscular tissue	52.6	53.0	55.4	3.5	ns
% bone	14.7	17.1	18.9	0.89	***a
% fatty tissue	28.3	26.1	21.9	3.2	**a
% chemical fat	28.0	25.9	21.5	2.6	**a
Muscle/bone ratio	3.58	3.15	2.94	0.21	***a
A (mm)	50.8	49.1	50.1	2.5	ns
B (mm)	25.5	25.7	22.7	1.7	**
LD area (cm^2)	9.54	8.77	7.79	0.66	***
LD length (cm)	47.4	47.8	51.1	2.1	***
Carcass length (cm)	86.0	88.6	92.9	1.9	***
Cut-leg length (cm)	39.0	41.3	43.6	1.2	***
F (mm)	219	246	263	10.1	***
T (mm)	167	175	186	4.7	***
C (mm)	4.1	2.9	1.8	0.66	***a
GR (mm)	10.4	8.8	5.5	1.7	***a

a Trial × muscling group interactions also significant.

area is influenced by skeletal (and LD muscle) length with longer carcasses having smaller cross sections.

The key finding of the present trials is the absence of significant differences in percentage carcass muscular tissue between carcasses selected for differences in muscling; if anything, the poorly muscled carcasses had most muscle. The present results support much research which has shown that LD area is a poor indicator of carcass muscle content (Kempster *et al.*, 1982). The poorly muscled carcass had the highest proportion of carcass bone.

The term 'muscling' can be defined as a visual assessment of muscle/bone ratio (Anon., 1982). The well muscled carcasses were superior in this regard. However, the well muscled carcasses also had high fat/muscle ratios. If the European definition of 'muscularity', i.e., the thickness of muscle in relation to skeletal size (Kempster *et al.*, 1982) is considered, then the well muscled carcasses had an advantage in this regard with respect to the LD muscle. As the well muscled carcasses had, if anything, a lower percentage of muscle, these observations highlight the importance of defining very clearly which term is being used when discussing well and poorly muscled carcasses.

All measures of fatness showed a trend from highest to lowest levels going from the well muscled to poorly muscled class. These results show that experienced meat industry personnel have based their selection on factors associated with a higher level of carcass fatness when choosing well muscled carcasses.

In present trials meat industry staff have been able to pick carcasses differing in muscling (as defined in Anon., 1982) and muscularity. However, the well muscled carcasses had the same proportion of lean meat as poorly muscled carcasses and tended to have more fat which was partly offset by a lower proportion of bone. These results suggest that the importance that the meat industry at the processing, wholesale and retail levels of the trade places on muscling (conformation, see Kempster *et al.*, 1982) may be a contributing factor to the problems of excess fatness associated with a proportion of export lamb carcasses (Frazer, 1982). This situation highlights the need to establish the relative importance of the proportion of muscle in the meat/carcass, muscling and muscularity to consumers in our various markets. Finally, it should be emphasised that the poorly muscled carcasses in the present trials were difficult to locate except at light weights suggesting that they form a low proportion of the national kill. The best way to eliminate poorly muscled carcasses may be to increase carcass weights.

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