The effect of changing processing conditions on the quality of *Longissimus lumborum* and *Semitendenosus* from beef carcasses.

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Introduction

Recent years have seen constant changes in the method of slaughtering and processing of cattle. In New Zealand most carcasses are subjected to high voltage electrical stimulation as part of Accelerated Conditioning. In addition, electrical stunning may be used at slaughter and, following slaughter various combinations of immobilisation and spinal discharge to facilitate dressing. As a result carcasses receive several electrical inputs which interact with each other (Petch and Gilbert, 1997) and can affect meat quality (Morton *et al.*, 1997). In this paper we compare the changes in carcass characteristics of Angus steers processed before and after the introduction of a new processing regime. The two muscles studied were the *Longissimus lumborum* or strip loin and the *Semitendenosus* or eye round. In addition we determined the colour of the meat because there were concerns about paleness.

Objectives

1. To determine whether changes in processing conditions altered meat quality characteristics.
2. To compare post mortem changes in the *Longissimus lumborum* and *Semitendenosus.*
3. To determine the colour of these cuts of meat.

Methods

In December, 1996 eight Angus steers (mean carcass weight 270 kg) were slaughtered and processed at a commercial processing plant. They were stunned using a captive bolt and the carcasses subjected to high voltage electrical stimulation about thirty minutes after slaughter. In September 1997 ten Angus steers (mean carcass weight 302 kg) were slaughtered and processed at the same plant. They were electrically stunned and after slaughter the carcasses were immediately immobilised and then electrically stimulated using a rubbing rail.

The temperature and pH of the meat was determined using an Orion 8163 glass electrode and a temperature probe attached to a Hanna H19025 portable pH meter. Initial measurements were at the legging stand for the LD and at the end stand for measuring the eye round. Further temperature and pH measurements were made over the 30 hours following slaughter. Samples were removed for tenderness determination at 6h, 12h, 4 days and 14 days. The shear force of cooked samples was determined using a MIRINZ tenderometer (Chrystall and Devine, 1991). A Minolta colorimeter was used to measure the colour of the meat.

Results and Discussion

Changes in the processing have lead to a dramatic increase in the rate of cooling for both the LD and the ST (Table 1) with the temperature of both muscles declining to less than 10°C by 10 hours after slaughter. There was unlikely to be any risk of cold shortening as there was also a rapid decline in pH with the muscles reaching their ultimate pH within 2 hours *post-mortem.* With regards to pH there was a more rapid pH fall than with earlier systems but the ultimate pH of both muscles higher (Table 1).
Both muscles showed the expected ageing curves with the ST tougher than the LD at all times (Figure 1). The LD shows a greater response to ageing (Table 1). The change in conditions had an interesting effect on the LD ageing curve. The initial post-mortem decline in shear force was steeper but the meat was less tender at 14 days as shown by a shear force of 6.37kgF in 1997 compared with 5.4kgF in 1996. In New Zealand two levels of tenderness are important. Meat tougher than 11kgF (as measured by the MIRINZ tenderometer) is outside the AC&A (Accelerated conditioning and Ageing) specifications while in the Quality Mark scheme a shear force of less than 8kgF is ideal. In 1997, all the LD samples were less than 11kgF within 24h and all but one was less than 8kgF by 4 days after slaughter. Only 20% of the ST from 1997 were less than 8kgF after 14 days ageing.

Table 1. Effect of processing on temperature, pH and shear force in the LD and ST. Standard errors are given in brackets. All times are post slaughter.

	Temperature (°C)		pH		Shear Force (kg)	
	1 hour	10 hours	1hour	ultimate	1 day	14 days
LD (1996)	33.26± 0.40	10.2± 0.35	5.97± 0.07	5.52±0.01	9.15±0.58	5.43±0.39
LD (1997)	25.58± 0.70	7.72± 0.30	5.72± 0.06	5.64±0.01	8.69±0.30	6.37±0.23
ST (1996)	30.25± 0.52	13.74± 0.73	5.94 ±0.04	5.52±0.01	10.12±0.68	7.98±0.24
ST (1997)	26.41± 0.80	9.1± 0.51	5.73±0.04	5.66±0.02	10.34±0.25	8.8±0.23

The meat was also tested for colour as anecdotal evidence suggested that there was a paleness problem in the ST following the introduction of new processing methods. The "ideal" colour of beef as measured in consumer preference surveys equates to the following values on our scheme: lightness (L*) 33, redness (a*) 17 and yellowness (b*) 8 (Hopkins, 1996). Rapid post-mortem falls in pH often lead to lighter meat. An extreme example of this is PSE pork which has L* values above 50. Table 2 shows the ST is considerably paler than the LD and becomes paler with age.

Table 2. Effect of ageing on the lightness (L*), redness (a*) and yellowness (b*) of the LD and ST.

Muscle	Hours post-mortem	L*	a*	b*
LD	24	34.58	21.76	2.5
	96	37.95	28.24	9.08
ST	24	45.48	24.11	5.9
	96	48.49	30.25	12.31

Conclusions

1. The ST is tougher than and ages less than the LD.
2. The changes in processing conditions have lead to a more rapid decline in temperature, pH and shear force
3. Meat produced under the new conditions has a higher ultimate pH and is tougher.
4. There is a potential colour problem with the ST becoming very pale after ageing.

References

Hopkins, D.L. (1996). Meat Focus International, 400-401

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Figure 1: Comparison of tenderisation of the LD (a) and ST (b) under new (-■-) and old (-●-) processing conditions.