Tenderstretch

Tenderness is one of the most important attributes of the eating quality of meat. The major animal/carcase factors that affect the tenderness of meat are:

- selection of cut;
- animal age;
- cold shortening (muscle contraction that can occur during chilling);
- animal stress leading to high pH;
- the extent of ageing; and
- breed.

Contraction of the muscles during chilling can lead to increased toughness in meat. Carcases are chilled rapidly soon after slaughter to prevent the growth of bacteria and to minimise weight loss during chilling. The muscle fibres tend to contract when a muscle is chilled rapidly to below 12°C before the onset of rigor mortis. In those muscles that are free to shorten, this contraction may be sufficient to cause commercially significant toughness. Lean, light carcases chill more rapidly than do fat, heavy carcases, and yield tougher meat in muscles free to shorten.

Toughness caused by this muscle contraction can be prevented by accelerating the onset of rigor mortis using electrical stimulation; or by hanging the carcase in a way that will stretch the muscles and not allow them to contract, hence the name ‘Tenderstretch’.

Electrical stimulation involves the application of a suitable electrical current to the carcase either immediately after slaughter, or at the end of the dressing line. This rapidly converts the muscle glycogen to lactate, lowering the pH and speeding up the onset of rigor mortis so that by the time the muscle temperature is reduced, the fibres are unable to contract (cold shorten) and toughen. The degree of electrical stimulation must be controlled however, so that the pH does not fall so rapidly that there is the danger of heat shortening.

Figure 1. Tenderstretch beef sides in a chiller

Tenderstretch

Many of the valuable muscles are in the butt and loin of a carcase. For beef sides, these can be restrained from shortening during the rigor process by suspending the side from the eye of the aitch bone (obturator foramen) or the pelvic ligament (Figure 1). Whole carcases of sheep, lamb or veal can be suspended from the pelvic girdle.

In a small throughput beef plant the transfer to the aitch bone or ligament can be done using an extended S hook and a hoist. At higher line speeds a continuous process can be employed where the hook is inserted into the suspension point and the roller is placed on a separate rail at a lower height which rises to the level...
of the main rail (Figure 2). Capital cost can be reduced by replacing the stainless steel hook with a disposable rope of suitable length to hang the side at the same height. These procedures will normally require one additional person on the process line.

The sides must be left hanging in this manner during chilling or until rigor mortis is established. After this period, the side or quarter can be again hung from the Achilles tendon for transport or boning. Experience with trade cattle has shown that they return to close to the original shape even after weekend chilling.

Table 1: Effect on meat quality scores of suspending beef cuts by the Achilles tendon or aitch bone (assessment by panel after grill cooking)

<table>
<thead>
<tr>
<th></th>
<th>Achilles Hung</th>
<th>Tenderstretch</th>
<th>Change in Meat Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hindquarter</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tenderloin</td>
<td>73.5</td>
<td>70.9</td>
<td>Decreased</td>
</tr>
<tr>
<td>Rump</td>
<td>56.9</td>
<td>63.9</td>
<td>Improved</td>
</tr>
<tr>
<td>Striploin</td>
<td>55.3</td>
<td>61.2</td>
<td>Improved</td>
</tr>
<tr>
<td>Eye Round</td>
<td>47.3</td>
<td>48.3</td>
<td>No difference</td>
</tr>
<tr>
<td>Outside Flat</td>
<td>46.7</td>
<td>50.4</td>
<td>Improved</td>
</tr>
<tr>
<td>Topside</td>
<td>37.8</td>
<td>44.9</td>
<td>Improved</td>
</tr>
<tr>
<td>Forequarter</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cube Roll</td>
<td>62.9</td>
<td>65.9</td>
<td>Improved</td>
</tr>
<tr>
<td>Blade</td>
<td>55.8</td>
<td>55.3</td>
<td>No difference</td>
</tr>
<tr>
<td>Brisket</td>
<td>34.7</td>
<td>31.9</td>
<td>No difference</td>
</tr>
</tbody>
</table>

Table 2: Effect on meat quality scores of beef cuts suspended by the Achilles tendon or aitch bone (stir fried)

<table>
<thead>
<tr>
<th></th>
<th>Achilles Hung</th>
<th>Tenderstretch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tenderloin</td>
<td>76.0</td>
<td>75.2</td>
</tr>
<tr>
<td>Striploin</td>
<td>54.8</td>
<td>56.8</td>
</tr>
<tr>
<td>Topside</td>
<td>43.8</td>
<td>47.6</td>
</tr>
<tr>
<td>Outside Flat</td>
<td>41.0</td>
<td>47.6</td>
</tr>
</tbody>
</table>

The meat quality score is derived from consumer test results and includes an assessment of tenderness, juiciness, flavour and overall liking. Higher scores indicate superior eating-quality satisfaction.

Tenderstretch allows the fibres of the muscles of some cuts, such as the tenderloin, to shorten. Any adverse effect on tenderness is small and usually not apparent to consumers. There is also no effect on forequarter cuts other than the cube roll as no extra tension is applied to these muscles.

Tenderstretch sides can be hung by either the aitch bone or the ligament (Figure 3).

The position effect on the striploin in normally hung carcasses (whereby the cranial portion had a higher palatability than the caudal portion), was reduced by suspension from the ligament (Table 3). When evaluated over several hindquarter muscles and
the loin muscle, there was a trend for suspension by the aitch bone to produce meat that was more palatable than the ligament method.

The results plotted in Figure 4 indicate that tenderstretching has almost the same effect on tenderness of cube rolls as ageing for 3 to 4 weeks at 0 to 1ºC. This suggests that there is little need for ageing of this cut from tenderstretched sides beyond 7 to 14 days. In contrast a significant improvement in tenderness occurs with ageing this cut from Achilles-hung sides right through to 4 weeks from processing. This relationship differs for different cuts. In some cases, the tenderness of a two-day-aged tenderstretch cut is equivalent to that of a two-week-aged cut from an Achilles-hung side.

Table 3: Effect of hanging method on meat quality scores at various positions along the LD muscle

<table>
<thead>
<tr>
<th>Position</th>
<th>Achilles</th>
<th>Tenderstretch Aitch Bone</th>
<th>Tenderstretch Ligament</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cranial end</td>
<td>54.8</td>
<td>60.0</td>
<td>59.2</td>
</tr>
<tr>
<td>Centre</td>
<td>54.8</td>
<td>56.8</td>
<td>53.3</td>
</tr>
<tr>
<td>Caudal end</td>
<td>49.6</td>
<td>48.4</td>
<td>56.1</td>
</tr>
</tbody>
</table>

Tenderstretch hanging is an alternative to electrical stimulation for achieving good sheepmeat eating quality; it is best suited to the domestic short-aged market.

An advantage of tenderstretch lies in the uniformity of eating quality between cuts. For example, if older sheep are Achilles-hung there are marked differences between the different cuts, to an extent not seen with lamb; however, if they are tenderstretch-hung, the marked differences between cuts are eliminated.

In some cases the economic advantage for tenderstretching beef sides may be reduced by the fact that, with some chiller designs, fewer tenderstretch than Achilles-hung sides can be accommodated in a chiller. A rail spacing of 900 mm is normally sufficient to accommodate tenderstretched carcases from local trade cattle.

Tenderstretch is a process that has been proven effective in improving the tenderness of the commercially valuable cuts from carcases of both cattle and smallstock. Although there is an increased cost with the process, MSA grading offers the potential for tenderstretch to increase returns to processors from the sale of beef with improved eating quality.
Further information

Meat Standards Australia. MSA11 – How tenderstretch affects beef eating quality. MLA tips & tools.


The information contained herein is an outline only and should not be relied on in place of professional advice on any specific matter.

For more information, contact one of the Meat Industry Services staff listed below.

Food Science Australia Meat Industry Services Section
The Meat Industry Services (MIS) section of Food Science Australia is an initiative supported by Meat and Livestock Australia (MLA) and the Australian Meat Processor Corporation (AMPC) to facilitate market access for, and support world-class practices in, Australia’s meat industry.

Need additional help, information or advice? Contact one of the following:

BRISBANE: Ian Eustace Neil McPhail
Ph. 07 3214 2117 Ph. 07 3214 2119
PO Box 3312 Fax. 07 3214 2103 Fax. 07 3214 2103
TINGALPA DC Old 4173 Mob. 0414 336 907
Cheryl Masson Donna Knox Frank Shaw
Ph. 07 3214 2101 Ph. 07 3214 2109 Ph. 07 3214 2001
Fax. 07 3214 2103 Fax. 07 3214 2103 Fax. 07 3214 2103
Mob. 0416 198 402 Mob. 0416 198 402 Mob. 0416 198 402

SYDNEY: Food Science Australia
Ph. 02 4567 7952
PO Box 181
PRIVATE BAG 16
KURMOND NSW 2757

Jocelyn Midgley
Ph. 03 9731 3424
Fax. 03 9731 3250
Mob. 0414 647 231

ADDITIONAL COPIES OF THIS NEWSLETTER ARE AVAILABLE FROM: www.meatupdate.csiro.au