

Meat Technology Update

Newsletter 1/04

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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. Carcasses 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 carcasses chill more rapidly than do fat, heavy carcasses, 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 carcass 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 carcass 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 carcass. 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 carcasses 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

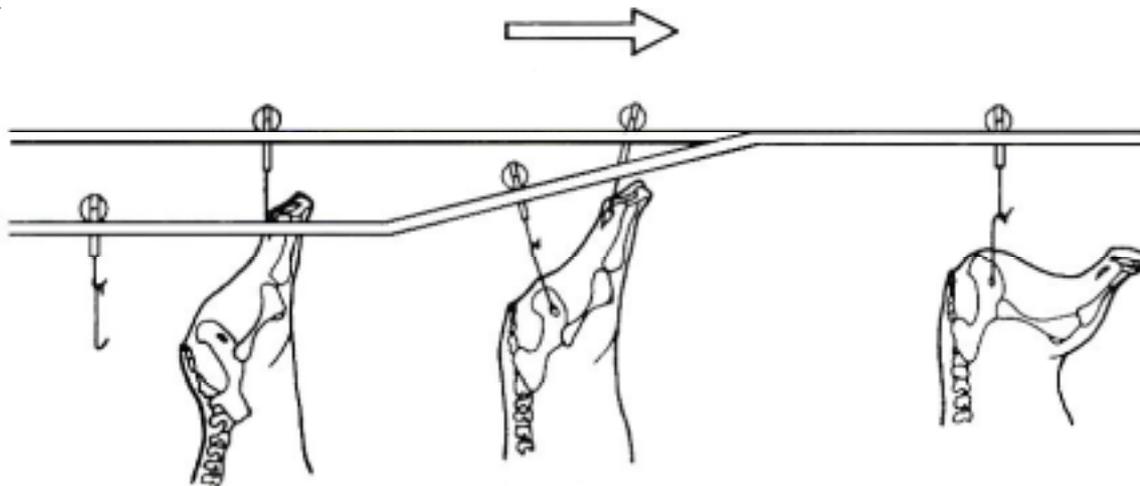


Figure 2. Changeover to tenderstretch

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)

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

The application of tenderstretch results in more tender meat for most cuts from the major leg muscles than does conventional Achilles-tendon hanging. The effect is most marked in the topside, loin, rump and outside flat (Tables 1 and 2).

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

	Achilles Hung	Tenderstretch
Tenderloin	76.0	75.2
Striploin	54.8	56.8
Topside	43.8	47.6
Outside Flat	41.0	47.6

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



Figure 3. Sides can be hung by the aitch bone (L) or the ligament (R).

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 1°C. 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

Position	Achilles	Tenderstretch Aitch Bone	Tenderstretch Ligament
Cranial end	54.8	60.0	59.2
Centre	54.8	56.8	53.3
Caudal end	49.6	48.4	56.1

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 carcasses from local trade cattle.

Tenderstretch is a process that has been proven effective in improving the tenderness of the commercially valuable cuts from carcasses 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.

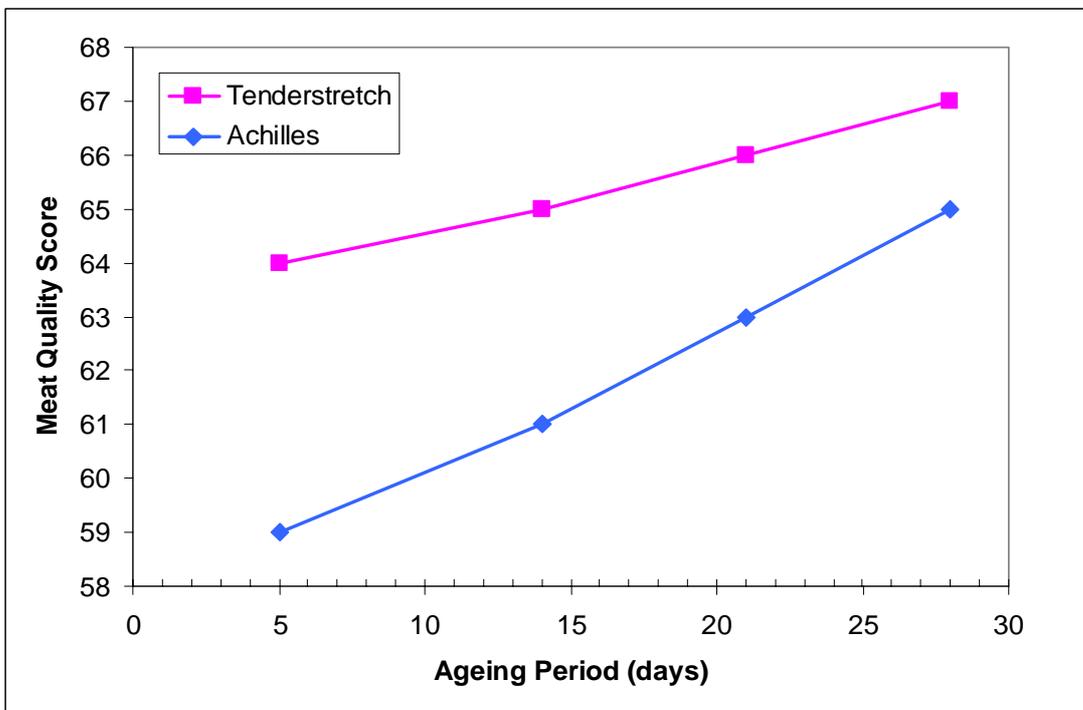


Figure 4. Effect of ageing on tenderness of cube rolls

Further information

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

Thompson, J (2002). Managing meat tenderness. Meat Science 62, 295–308.

Maximising lamb and sheepmeat eating quality – a guide for Australian lamb and sheepmeat processors (2003). Meat & Livestock Australia.

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:*

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