

Good practice can reduce acute stress and water loss from meat

FACTSHEET 3

Acute stress can affect the eating quality of meat. Good practices required by conformance and quality management programs help reduce acute stress and water loss from meat.

Key points

- Muscle contains 70-80% water. Loss of this water from the meat means less weight to sell.
- Drip loss from the carcass, purge from a primal and water loss during cooking are three ways in which water is lost.
- Good practices can help reduce acute stress and water loss from meat.

Why stress and water loss are issues



Meat has a high percentage of water and when this water is lost after slaughter, the weight of saleable product is also reduced, causing significant decrease in product value.

Water is lost in three ways: drip loss from the carcass, purge from the primals and cooking loss from the meat during the cooking phase.

Conformance or quality management programs require good practices that reduce stress pre-slaughter to be implemented and audited to ensure they are practiced. This can assist in identifying and eliminating incidents of acute stress prior to slaughter which can in turn deliver greater profits through increased carcass weight and higher value meat products.

Calm handlers help avoid stressful animals during pre-slaughter handling which reduces the risk of water loss.

Causes of stress and water loss

Acute stress causes an increase in water loss from meat. Acute stress can be caused by any activity that causes a “fight or flight” response from the animal leading to the release adrenaline. These include:

- use of electric goad or prodders
- increased closeness of human contact
- unsuitable handling equipment and conditions
- novel or unfamiliar environments and animals
- loud noises
- isolation
- strange odours, and
- poor lighting.

Acute stress impacts the structure and composition of the muscle which then impacts its water holding capacity. Meat with low water holding capacity has increased losses of water prior to sale and is drier to eat, potentially resulting in a poor eating experience for the consumer.

The mechanism through which acute stress impacts the water holding capacity includes:

- A fast fall in muscle pH and high muscle temperatures leading to protein denaturation particularly of the sarcoplasmic proteins and of the myosin head. Change in these proteins causes shrinkage of the myofibrillar lattice increasing extracellular water and water loss from muscle.
- A shift in ions from the muscle cells into the plasma pre-slaughter. Due to a shift in osmolarity and an increase in osmotic pressure in the extracellular space, water travels from inside the muscle cells to outside the cells causing a loss of water post-mortem from the muscle.
- The release of stress hormones (adrenaline, nor-adrenaline and cortisol) and the subsequent breakdown of stored energy in the form of glycogen from the liver and muscle to produce energy. Glycogen stored in the muscle or liver is hydrated with 3-4 parts water, hence acute stress will deplete water storage in the muscle and the capacity of the muscle cells to sequester water due to a lower concentration of glycogen.

Good practices required by conformance or quality management programs to help reduce acute stress and water loss from meat

Conformance or quality management programs with good practices aimed at eliminating stress should be actively adopted in your operation as they will:

1. reduce water loss from meat
2. improve the juiciness of meat, and
3. improve customer satisfaction and deliver greater returns.

A reduction in stress and the risk of water loss can be achieved through a number of simple practices:

- DO carry out handling and movement of livestock calmly and effectively, avoiding harm, distress and injury.
- DO ensure that all facilities used to handle the animals, including transport vehicles are free from any flaws that could cause injury to the animals.
- DO ensure animals have enough space in pens to stand up, lie down and turn around.
- DO protect animals from exposure to adverse weather conditions.
- DO ensure that equipment used to handle animals is in good repair and working order.
- DO restrain animals effectively during the slaughter process.
- DO NOT subject livestock to procedures that cause pain or suffering.
- DO NOT isolated animals.
- DO NOT force livestock to walk over the top of other animals.

Meat with low water holding capacity can result in a poor eating experience for the consumer.

Benefits of good practice

Reducing the amount of acute stress during the pre-slaughter period through the implementation of good practices required by conformance or quality management programs will:

- Reduce the drip loss from a carcass resulting in a greater weight in carcasses to be sold.
- Reduce the purge in vacuum packaged meat resulting in a greater weight available for sale.
- Reduce cooking loss and purge after cooking resulting in better presentation for food service, smaller proportions needed to meet advertised serve weights and a better eating experience.

Economic cost to processor of drip loss from carcasses (per day)

= 0.6% extra drip loss * Average (Av.) carcass weight * No. animals slaughtered * Cost per kg

Beef example for processor killing 150 head = 0.6% * 230kg * 150 * AUD \$5.50 = \$1,138.50 per day

Sheep example for processor killing 1,000 head = 0.6% * 26kg * 1,000 * AUD \$5.00 = \$780 per day

Economic cost of purge to wholesaler from primals at six days of ageing

= 0.6% extra purge * Av. carcass weight * Av. primal yield * No. animals slaughtered * Cost per kg

Beef example for processor killing 150 head = 0.6% * 230kg * 68% * 150 * AUD \$5.50 = \$774.18 in weight lost from primals from one days kill

Sheep example for processor killing 1,000 head = 0.6% * 26kg * 85% * 1,000 * AUD \$5.00 = \$663.00 in weight lost from primals from one days kill

Economic cost of purge to wholesaler from primals at 21 days of ageing

= 1.9% extra purge * Av. carcass weight * Av. primal yield * No. animals slaughtered * Cost per kg

Beef example for processor killing 150 head = 1.9% * 230kg * 68% * 150 * AUD \$5.50 = \$2,451.57 in weight lost from primals from one days kill

Sheep example for processor killing 1,000 head = 1.9% * 26kg * 85% * 1,000 * AUD \$5.00 = \$2,099.50 in weight lost from primals from one days kill

Values for drip loss and purge come from Warner et al. (2007)

Further reading

- *Factsheet 1: Good practice can reduce dark cutting for better meat quality and higher returns*
- *Factsheet 2: Good practice can reduce stress and improve eating quality*
- *Factsheet 4: Good practice can reduce bruising resulting in less trimming and less carcass wastage*
- *Factsheet 5: Good practice delivers benefits from improved infrastructure*
- *Factsheet 6: Good practice can reduce animal stress and shrinkage for increased profits*
- *Factsheet 7: Good practice in the provision of quality feed and clean fresh water can improve growth rates and eating quality*
- *Factsheet 8: Good practice in reducing slipping and falling can improve hide cleanliness and carcass hygiene*
- *Factsheet 9: Good practice avoids mixing unfamiliar livestock which can reduce stress and improve eating quality*
- *Factsheet 10: Good practice in traceability delivers health and safety control and improves management decisions*
- *Factsheet 11: Good practice reinforced through training*
- *Factsheet 12: Support and training in good practice*
- Warner RD, Ferguson DM, Cottrell JJ and Knee BW (2007). *Acute stress induced by the pre-slaughter use of electric prodders causes tougher beef meat*. Australian Journal of Experimental Agriculture 47: 782-788.