

Merinos can deliver

Key points

- Sheepmeat with a high pH can be less acceptable to consumers, both in appearance and eating quality.
- A high muscle pH results after slaughter due to insufficient glycogen (energy) in the muscles at slaughter.
- Merinos are more susceptible to high pH meat but management and breeding can reduce the incidence of such meat.

Introduction

Merinos can produce meat of high quality in terms of tenderness, flavour and overall acceptability. However, Merinos are more susceptible than other breeds to producing meat with a high post-slaughter pH. Consistent high quality lamb products are required to maintain consumer confidence and consumption. The eating quality of meat is predominantly derived from the tenderness, flavour, odour and juiciness traits and in lamb, flavour is as equally important as tenderness.



Figure 1. A section through the striploin showing dark-cutting meat, one result of high pH meat.

What causes high pH meat?

High pH meat is a persistent quality defect found in meat from all species of animals. After slaughter, the carcass normally undergoes rigor (stiffening) and the pH of the meat drops (becomes more acid). In some carcasses, the muscle tissue pH does not drop enough. This results in meat with a high pH, which is a direct consequence of low muscle glycogen (energy) at slaughter and this can cause the meat to be a noticeably darker colour.

Meat with a pH greater than 5.7 has poorer keeping and eating qualities and as the pH increases above 6.0, the colour can be unattractively darker, is less desirable to consumers, is less tender (in the pH range of 5.8–6.2), tends to have off-flavours, spoils more rapidly and requires a longer cooking time.

If high pH meat is vacuum-packed, greening will occur in the bag fairly quickly due to the proliferation of sulphur-producing bacteria. The prevalence of high pH sheep meat in Australia is about 10% in lamb loins purchased at the retail counter as tested in four Australian cities, but data is not available for other cuts.

Merinos have produced higher pH meat in experiments when compared to first- and second-cross lambs (sired by Border Leicester and Poll Dorsets). There were also observed differences between strains of Merinos where two superfine strains exhibited higher pH than the medium and broad wool strains, tested in the loin and the leg.

The appearance and colour of the product in retail display determines economic returns to the supermarket and a one-day reduction in shelf-life of a meat product can cost them millions per year with consistent high quality lamb products required to maintain consumer confidence and consumption. Losses at the retail end are inevitably shared back through the production and processing chain resulting in lower prices paid to absorb those costs.

What causes glycogen loss?

Glycogen levels in the muscle can be thought of as available energy. Practices that cause stress such as transport, time off feed, mustering and mob mixing, as well as unfamiliar environments such as saleyards and abattoir lairage, cause the animal to use up this energy. These factors can individually and additively affect the ultimate pH of sheepmeat. Merino lambs are often more susceptible than crossbred lambs to the effects of stress on muscle glycogen concentration. In a comparison of five genotypes, the Merinos had the highest ultimate pH in the knuckle (leg muscle), but pH was similar in the loin.

Merinos do not appear to have inherently low levels of muscle glycogen, but they deplete more muscle glycogen between farm and slaughter. In general, on-farm factors appear to be more important than transport and lairage factors in determining how likely the breed and consignment is to produce high pH meat.

Shearing close to slaughter can increase the energy requirements of a lamb for maintenance and cause a negative effect on muscle glycogen concentration, and hence lamb meat eating quality. If lambs are shorn prior to slaughter this is best done before the finishing period and at least four weeks before slaughter. Refer to Meat Standards Australia Tips & Tools information kit (to order hard copies telephone Meat Standards Australia on 1800 111 672).

There is some evidence that Merinos are more sensitive to stress hormone than crossbreds and therefore are more likely to mobilise glycogen (energy) between farm and slaughter. Therefore Merinos may actually mobilise more glycogen in response to any stressor, emphasising the importance of minimising stress pre-slaughter.

Are there implications from high wool production?

Research has indicated that Merinos selected for high fleece weights may pay a penalty in other traits. Selection for increased fleece weight can result in a higher meat pH. High wool production may also be at the expense of fat, which may compromise the ewe's ability to rejoin and rear lambs. Further work is required to better understand the extent of these penalties.

How can high glycogen levels in muscle be maintained?

Practices that reduce stress or reduce the animal's susceptibility to stress, will improve glycogen levels at slaughter and therefore reduce the risks of producing high pH meat.

Increasing muscle glycogen at slaughter can be achieved by: Feeding either high concentrate diets or high quality pasture on-farm pre-slaughter. This will generally increase storage of glycogen in muscles. This is best achieved with a growth rate of 150g/day for 2 weeks pre-slaughter (see Meat Standards Australia Tips & Tools referred to above).

The addition of magnesium oxide to the finishing ration can help to reduce the effect of stress on muscle glycogen reserves. However this is not an alternative to and should not be substituted for good feed and welfare management of lambs. The recommended rate of addition of magnesium oxide to finishing rations is 1%. This should be added for 4 days only, just prior to sending to slaughter; the value of this effect will be reduced if magnesium is fed for longer than this period of time.

Reducing stress pre-slaughter will reduce the rate of depletion of muscle glycogen. Causes of stress include prolonged lairage and transport periods as well as on-farm stressors.

Can selective breeding improve muscle glycogen levels?

Using sires with genetically superior eye muscle depth (selected on Australian Sheep Breeding Values or ASBVs) improves muscle glycogen in Merino lambs given adequate nutrition.

Also, if these high ASBV Merino lambs have their glycogen stores depleted through stress, these animals are more responsive to replenishing glycogen stores when re-fed high energy diets. It is therefore recommended to select Merino sires with yearling eye muscle depth (YEMD) ASBVs of greater than zero.

The temperament of an animal is likely to have an impact on maternal behaviour (and therefore lamb survival and growth rate) as well as meat quality (and muscle glycogen). Temperament is measured in beef cattle and more recently sheep, using an 'agitation' score, which is heritable.

While less agitation in cattle reflects better meat (through more glycogen), results in sheep are not so clear. One experiment showed that Merinos had the highest pH but the lowest agitation score compared to Poll Dorset and Border Leicester crosses. This indicates that this measure may not be a good indicator of stress in Merinos and that outward behaviour as an indicator of internal stress, may differ between breeds.



Figure 2. Merino lambs being finished on-farm



Figure 3. Poll Merino rams selected for high yearling eye muscle depth.

What are the future implications?

Understanding and managing the factors that cause stress to Merino lambs pre-slaughter will enable Merino producers to produce a consistent high quality meat, comparable with lambs traditionally bred for meat production.

A better understanding of the measure of stress in Merinos, if it differs to other breeds, may also add value to the management of other aspects of the production system, such as reproduction and lamb survival.

Take home messages

- Merinos can produce meat of high quality if problems associated with susceptibility to high pH meat are addressed.
- Provide good nutrition from pasture or supplements to lambs two weeks before consignment, sufficient to grow at 150g/day.
- Minimise stress factors on-farm and between farm and slaughter.
- Use sires with Australian Sheep Breeding Values for YEMD >0 mm.

Further information

For further information visit www.sheepcrc.org.au and click on Information Services

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