More muscling reduces dark cutting

NEW Beef CRC-funded research conducted by Western Australia's Murdoch University has shown that increased muscularity is a factor associated with lower ultimate carcase pH, leading to a reduced incidence of dark cutting.

In 2009, dark cutting cost the Australian beef industry around $35 million.

"Dark cutting meat is dry to taste, spoils very quickly, has variable tenderness and is very dark in colour," said Peter McGilchrist, who conducted the research with his colleagues at Murdoch.

If there is low glycogen in the muscle, the pH remains elevated and the meat will be dark.

Based on Meat Standards Australia, when a carcase ultimate pH exceeds 5.7 dark cutting is triggered.

For a steak to be a desirable bright cherry-red colour, the pH of the meat must drop from a pH of 7 at slaughter down to an ultimate pH of less than 5.7 in the 24 hours after slaughter.

Meat from carcases with an ultimate pH in the loin higher than 5.7 has darker meat colour, shorter shelf life, bland flavour, variable tenderness and resists cooking.

In 2009, Meat Standards Australia (MSA) graded more than one million cattle with 5.45 per cent having a pH greater than 5.7 (see Figure 1).

Due to its effect on quality, beef producers are commonly penalised up to 50c per kilogram carcase weight for carcases with a pH greater than 5.7.

In carcasses less than 350kg, the effect of increased eye muscle area (EMA) from 40 to 80cm2 reduced the proportion of noncompliant carcases with an ultimate pH above 5.7 from around 22pc to 6pc.

In carcases over 350kg the non-compliance level dropped from around 8pc to 3pc as EMA increased from 50 to 80cm2.

The current average EMA from all MSA data across Australia is 64cm2.

Producers should aim to produce animals that have an EMA greater than 70cm2 for a 250kg carcase.

"If muscling is increased to slightly above average, to around 70 or 75cm2, this should greatly minimise the risk of dark cutting," Mr McGilchrist said.

To achieve this, producers should utilise sires with an estimated breeding value (EBV) for EMA higher than the average. Producers can evaluate their current position by viewing MSA feedback sheets which give EMA measurements, thus allowing appropriate breeding and management decisions to be made.

Muscling and insulin and adrenaline sensitivity

Overall, muscle glycogen at slaughter is a function of initial muscle glycogen on-farm, minus the quantity of glycogen loss due to stressors during the pre-slaughter period.

Animals with low initial glycogen concentrations that undergo similar pre-slaughter stress are more susceptible to dark cutting.

In a separate study, Mr McGilchrist found that heavier muscled animals had increased insulin sensitivity and decreased adrenaline sensitivity.

This indicates that more muscular cattle have increased glycogen synthesis after eating and reduced glycogen breakdown during stress.

Both of these conditions result in increased muscle glycogen at slaughter, increasing the likelihood of having sufficient muscle glycogen for the carcase to reach an ultimate pH below 5.7.

Importance of muscling

A reduction in the incidence of dark cutting in high muscled cattle complements the other advantages of muscular cattle, such as increased retail beef yield and processing efficiency.

The relationship between increased muscling and reduced dark cutting is a very important finding for the beef industry, as it demonstrates that beef producers can actively select for more muscular cattle knowing it will help to reduce the incidence of dark cutting carcasses in their herd.

Using data collected on 204,071 MSA graded carcases at one WA processor from February 2002 to December 2008, Beef CRC researchers led by Mr McGilchrist investigated a range of animal and pre-slaughter factors that impact on the rate of dark cutting.

Data recorded for each carcase included weight, fat depth, marbling, eye muscle area and physiological age (ossification). In addition, lot size and finishing system (grain versus grass) were recorded.

Overall, 8.75pc of carcases graded at the processing plant had an ultimate pH greater than 5.7, which tends to result in dark cutting.

From 2002 to 2008, the average carcase eye muscle area and marbling increased while physiological age (ossification) at slaughter decreased, indicating that animals were younger at slaughter.

Carcase rib fat depth averaged between eight and 11 mm and reflected the differences in animal nutrition between years.

Carcaseweight and rib fat depth

Increasing carcase weight and carcase rib fat depth were both associated with reduced rates of dark cutting.

As carcase weight increased from 150kg to 220kg the predicted proportion of carcases with a pH above 5.7 decreased from around 18pc to 5pc.

This indicates there is a very high incidence of dark cutting in very light vealer type cattle. As carcase weight increased beyond 250kg, the proportion of carcases with an ultimate pH higher than 5.7 continued to decrease, but at a slower rate.

As rib fat depth increased from 0 to 20 mm, the predicted proportion of non-compliant carcases with an ultimate pH above 5.7 decreased from about 14pc to 4pc.

"The relationship between increasing carcase weight and rib fat depth are likely to be associated with better nutrition of heavier and fatter cattle," Mr McGilchrist said.

"Animals that are heavier and have higher rib fat can be assumed to have received better nutrition in the months leading up to slaughter, allowing for high muscle glycogen concentrations."

An interesting finding was that carcase marbling, as assessed by MSA, was not associated with rate of dark cutting, even though carcase rib fat depth and carcase weight were.

Physiological age of carcass

Ossification is measured in increments of 10 from 100 to 590 and is an assessment of physiological age of a carcase. Physiologically older animals have higher ossification scores.

Overall, lower ossification scores in cattle at the same carcase weight indicate a more rapid growth rate throughout life.

What causes dark cutting?

Dark cutting is associated with insufficient muscle glycogen reserves in the muscle at the time of slaughter.

The amount of glycogen present in the muscle before slaughter determines how much lactic acid the muscle is able to produce.

If there is insufficient muscle glycogen at time of slaughter, the carcase pH decline will not be sufficient to reach an ultimate pH of below 5.7. If there is low glycogen in the muscle, the pH remains elevated and the meat is dark.

Courtesy of The Land

This article has been adapted from a journal article submitted to Meat Science titled 'Increased eye muscle area, lower ossification scores and improved nutrition have a lower incidence of dark cutting'.