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Investigating teeth eruption and eating quality

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TEETH ERUPTION and EATING QUALITY

In Australia, a sheep ceases to be a lamb as soon as the eruption of its first permanent incisor teeth is evident. As part of a wider program to investigate a number of aspects of sheep meat eating quality, a project was undertaken to determine whether lamb eating quality would be compromised if sheep with partially erupted teeth continued to be classified as lamb. Dr Sarah Wiese, Dr John Milton, Rob Davidson, Dr Brian McIntyre, Dr David Pethick and Dr John Thompson report.

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The timing of teeth eruption is highly variable and can range from 10 to 18 months of age. Post teeth eruption, the carcase is classified as hogget and the price paid is substantially less than that for lamb.

In New Zealand, a young sheep is still considered to be a lamb after the first permanent incisor teeth erupt as long as they are not in wear. Allowing sheep with partially erupted teeth to be classified as lamb enables producers to grow lambs out to heavier weights, and also allows for a warning period during which the lambs can be sold.

This practice would enable Australia to compete for a greater share of the European Union and United States markets, both of which not only pay the highest prices for lambs, but are also seeking heavier carcases.

The project

A study commenced to compare the eating quality of young sheep with milk teeth, partially erupted and fully erupted permanent incisor teeth. The study involved assessing young sheep over three production systems contributing to the Australian prime lamb industry - pure Merino, First cross (Border Leicester sires over Merino ewes) and Second cross (Poll Dorset sires over Border Leicester x Merino ewes).

Each group of young sheep was run on a different commercial farm and was slaughtered on a different day. The study was not designed to compare the genetic differences between the groups. Rather, the objective was to replicate the experiment over three diverse production scenarios.

The lambs were weighed, condition scored, and had their teeth examined fortnightly. The entire
Table 1. Objective and sensory measures of eating quality for young sheep from three different production systems.

<table>
<thead>
<tr>
<th></th>
<th>Production system 1</th>
<th>Production system 2</th>
<th>Production system 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Merino</td>
<td>First cross</td>
<td>Second cross</td>
</tr>
<tr>
<td></td>
<td>Milk</td>
<td>Partial</td>
<td>Full</td>
</tr>
<tr>
<td>Meat colour (L)</td>
<td>34.6</td>
<td>34.8</td>
<td>34.4</td>
</tr>
<tr>
<td>Muscle pH (1 – 14)</td>
<td>5.58</td>
<td>5.56</td>
<td>5.56</td>
</tr>
<tr>
<td>Cooking loss (%)</td>
<td>33.8</td>
<td>33.8</td>
<td>33.0</td>
</tr>
<tr>
<td>Shear force (kg)</td>
<td>2.48</td>
<td>2.33</td>
<td>2.39</td>
</tr>
<tr>
<td>Glycogen (g/100g)</td>
<td>9.18</td>
<td>9.44</td>
<td>10.19</td>
</tr>
<tr>
<td>Intramuscular fat (%)</td>
<td>8.68</td>
<td>9.18</td>
<td>9.57</td>
</tr>
<tr>
<td>Tenderness</td>
<td>66.4</td>
<td>70.2</td>
<td>72.4</td>
</tr>
<tr>
<td>Juiciness</td>
<td>55.9</td>
<td>60.3</td>
<td>62.9</td>
</tr>
<tr>
<td>Flavour strength</td>
<td>55.8</td>
<td>60.8</td>
<td>62.2</td>
</tr>
<tr>
<td>Flavour liking</td>
<td>64.2</td>
<td>67.4</td>
<td>68.5</td>
</tr>
<tr>
<td>Overall liking</td>
<td>63.9</td>
<td>69.5</td>
<td>70.2</td>
</tr>
<tr>
<td>Eating quality score</td>
<td>63.7</td>
<td>68.1</td>
<td>69.4</td>
</tr>
</tbody>
</table>

Highest values indicate:
- Lighter colour
- Poorer quality
- More water loss
- Less tender
- Better quality
- Stronger red colour
- More fat
- More tender
- More juicy
- Stronger flavour
- More likeable
- More desirable

line was consigned for slaughter when there were approximately equal proportions of animals with milk teeth, partially erupted and fully erupted incisor teeth. The final liveweight, condition score and dentition status of each animal was recorded on the day before slaughter.

The weight of the hot carcase and its fat score were recorded at slaughter. All carcases were subjected to 90 seconds of high voltage electrical stimulation to minimise the risk of cold shortening and the meat was also aged for four days. These procedures were applied to minimise the variable effects of processing.

Carcase measurements of fat depth, eye muscle area, meat colour and ultimate muscle pH were taken 48 hours after slaughter. Samples taken from the anterior m. Longissimus dorsi (back-strap) were used for measurement of post-slaughter glycogen level, intramuscular fat, myoglobin content (muscle pigment), Warner Bratzler shear force (measure of tenderness), and moisture loss during cooking.

A consumer taste panel evaluated the samples for tenderness, juiciness, flavour strength, liking of flavour and overall liking of the meat. These consumer taste panel scores were then combined into a sheep meat eating quality score.

In Australia, sheep are no longer considered lambs as soon as milk teeth (top) are replaced with partially erupted (centre) and then fully erupted (lower) central incisor teeth.
The study was conducted over three production systems, including Merino lambs at Shane Edwards’ Pantapin property (page 31), and First cross lambs at Jeff Murray’s property in Beverley (left).

Dr Dave Pethick from Murdoch University and Pantapin farmer Shane Edwards measure the pH of Merino lambs processed at Linley Valley Abattoir.

Conclusions

Of the 19 attributes assessed for the three production systems, only one attribute in one production system showed a significant negative result from allowing lambs to progress from having milk teeth to partially erupted teeth. This was an increase in muscle myoglobin content in the First cross lambs (i.e. their meat had a stronger red colour, but was not dark) and indeed this was a trend for all production systems.

An increase in myoglobin level is known to occur as animals increase in age. However, as the young sheep progressed from milk teeth to partially erupted teeth through to fully erupted teeth, many of the other attributes assessed showed changes that could be considered as positive for eating quality.

The average duration of teeth eruption during the study, from the first sign of partial eruption to fully erupted central incisor teeth, was 27.4 days. Allowing sheep with partially erupted teeth to be classified as lambs could therefore provide producers with a four week warning period in which to market their sheep.

However, there was considerable variation between animals for the duration of eruption, so producers could still face the risk of some animals reaching full teeth eruption faster than anticipated.

Overall, the results indicated that meat from young sheep with partially erupted teeth was unlikely to be inferior in eating quality than the meat currently classified as lamb.

Acknowledgements

Meat and Livestock Australia - Sheepmeat Eating Quality Program, the Department of Agriculture and Murdoch University supported this project.

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