Shelf-life of Australian vacuum packed beef - impact of meat colour

Food & Nutrition
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Extension of shelf-life to promote global competitiveness

Falling $AUS, advantageous to export markets

Opportunities for growth in other export markets—Free Trade Agreements (FTAs)

Increased demand for high quality Australian beef—especially with the rising Asian middle class

Enhancing our global competitiveness—differentiation in global environment
Background research

Does meat colour impact shelf-life & eating quality?

- 30 weeks (-0.5°C)
  - Micro & sensory ok
- pH can impact on micro & sensory
- Consumer acceptance lower in darker or paler muscles
- “bitter” “sour” “off”
- “less flavoursome” “less tender”
Long aged (20 weeks) vacuum packed chilled storage- design

3 meat colour scores
   1B, 1C (light)
   2, 3 (medium)
   4 and above (dark)

324 striploin samples from 3 export plants (mix of pasture & grain fed animals)

Stored at -1°C for 20 weeks at CSIRO

Assessed at 0, 2, 8, 12, 16 and 20 weeks

Determine effect of beef meat colour grade on:
   Biochemical properties
   Microbiological growth
   Eating quality
   Retail display
Appearance & odour on opening

Storing for longer reduced appearance & odour scores

Darker colours less acceptable after week 16
Biochemical properties

Dark meat had a higher pH & less glycogen whereas light & medium colours had a lower pH - similar values observed.

<table>
<thead>
<tr>
<th>Storage Week</th>
<th>Light (µmol/g)</th>
<th>Medium (µmol/g)</th>
<th>Dark (µmol/g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glycogen</td>
<td>37</td>
<td>37</td>
<td>33</td>
</tr>
<tr>
<td>Lactate</td>
<td>22</td>
<td>22</td>
<td>20</td>
</tr>
</tbody>
</table>

MLA 2011
Microbiology- TVC increased at 8 weeks and was higher in dark meat

Total viable count (TVC) increased at week 8 and reached a plateau.
- After week 8, dark muscles had higher values compared to light & medium coloured muscles.
Microbiology - LAB showed similar to TVC

**TVCs & LABs:**
- No major differences observed between plants
- 2 plants with hot water decontamination units

**Brocothrix:**
- Similar increase at week 8, but no difference between meat colours

**Chart Description:**
- Lactic acid bacteria (log cfu/sq cm) vs. storage week
- Dark colours higher lactic acid bacteria (LAB)
Eating quality using Meat Standards Australia (MSA)- weeks 2, 12 & 20 only

MQ4 score (out of 100) was calculated by adding 4 sensory components:

- Tenderness 30%
- Overall liking 30%
- Flavour 30%
- Juiciness 10%

- MSA eating quality guide separated into:
  - 3, 4, 5 star ratings
**MSA MQ4 by colour**

*Light colours continue to improve*

![Graph showing MQ4 score over storage weeks by colour](image)

- **Light**
- **Medium**
- **Dark**

**Improved eating quality with storage > 12 weeks**

Lighter colours continue to improve
Tenderness and juiciness scores increased with storage.

Flavour started to decrease at 20 weeks, apart from in the light coloured group.

Lighter colours continued to improve in eating quality.
Retail display steaks

Week 20, after 3 days retail display

Colour groups had a similar retail display life

Light

Steaks visually suitable
2 weeks = 6 days
12 weeks = 4 days
20 weeks = 3 days

Medium

Dark
In summary

Storing meat reduced the appearance and odour of the product, but all meat colours were still acceptable at week 20.

The development of spoilage associated microflora was more pronounced in dark muscles & consequently these muscles have a higher likelihood of reduced storage life.

All meat colours improved in eating quality with aging, especially between 2 and 12 weeks.

After 20 weeks storage, MQ4 scores indicate a 3 star product is achieved, meaning light & medium meat colours can achieve a “good everyday” eating quality when stored appropriately.
Future studies/ going forward

Determine shelf life/eating quality of long aged beef for export markets- “real life situation”
- especially to emerging markets
- Biochemical, microbiological & sensory/ eating quality

Current project looking at the effect of purge on shelf-life of vacuum packed chilled meat, especially for Egyptian clients.

<table>
<thead>
<tr>
<th>ABARES</th>
<th>Beef &amp; veal</th>
<th>Pork</th>
<th>Lamb</th>
<th>Chicken</th>
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<tbody>
<tr>
<td>Export vol</td>
<td>1,184/1611</td>
<td>47/360</td>
<td>250/ 470</td>
<td>38/1066</td>
</tr>
<tr>
<td>2013-14 kt</td>
<td>74%</td>
<td>13%</td>
<td>53%</td>
<td>4%</td>
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<tr>
<td>%</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Main export</td>
<td>USA, Japan &amp;</td>
<td>USA, Canada</td>
<td>Middle east,</td>
<td></td>
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<tr>
<td>markets</td>
<td>China</td>
<td>&amp; China</td>
<td>USA &amp; China</td>
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