Agriculture and Food Development Authority

The Irish Agriculture and Food Development Authority
Meat Quality Grading Today
Paul Allen
What is meat quality?

- Can mean different things at each point in the supply chain
- Consumer is ultimate arbiter – if it doesn’t satisfy expectations then they may not purchase again
- At point of sale – appearance is important – colour, fatness, marbling, lack of drip, packaging
- After cooking – tenderness, juiciness, flavour, overall experience
- Can be assessed by trained panels – more descriptors can be used
- Can be assessed by untrained consumers - large numbers
Why grade on palatability?

• Inconsistent eating quality – AUS, US, IRL
• Beef consumption declining
• Increased competition
• EUROP grading unrelated to palatability
• Consumers willing to pay for quality
Current meat quality grading

- Most countries DO NOT grade on eating quality
- Notable exceptions are US and Australia

- US – Carcasses graded on yield and quality
  - Quality grade is based on visual assessment of marbling (loin) and maturity (hand held camera systems can be used)
  - Marbling is the amount and distribution of visible flecks of fat within the eye muscle at 12\textsuperscript{th}/13\textsuperscript{th} rib
    - Marbling is primary factor in determining quality grade
  - Maturity (physiological age) is assessed visually
    - Degree of ossification of cartilage on vertebrae and spinal processes, colour of bones
    - Colour and texture (fineness of grain) of loin muscle (less emphasis than ossification)
- All these are combined to give an overall quality grade – Prime, Choice, Select

- Australia - Measures to improve tenderness known but not interactions - also based on expert panels not consumers
- MSA solution – predictive model using PACCP approach

The Irish Agriculture and Food Development Authority
The PACCP approach

Conception

Genetics

Nutrition

Pre-slaughter factors

Post-slaughter factors

Chilling/ageing

Processing

Packaging

Cooking

Consumer feedback

Critical Control Points

Consumption
MSA grading

- Assess effect of pre and post mortem factors to produce predictive model
- Effects measured as response of consumers
- Large database – 65,000 consumers, 420,000 samples
- Very detailed protocols for sampling, cooking etc.
Cuts based model

• Original model graded carcasses
• Became clear that cuts were different – can’t predict palatability of all cuts by grading carcass as cuts respond differently to various factors particularly ageing, carcass suspension and cooking method
• Therefore developed cuts based model – palatability of individual cuts predicted for range of cooking methods
Factors in the model

- **Predictors**
  - Breed (BI)
  - sex
  - growth rate
  - Electrical stimulation
  - hanging method
  - Marbling
  - Ossification
  - ageing
  - cooking method
  - pH
  - rib fat

- **Basic criteria**
  - minimum stress
  - **Thresholds for**
    - ossification score
    - pHu
    - colour
    - rib fat
Components of palatability

- Combination of all factors that make beef enjoyable to eat, assessed by sensory analysis and weighted to give quality score

- Main factors are
  - tenderness $\times 0.4$
  - juiciness $\times 0.1$
  - flavour $\times 0.2$
  - overall liking $\times 0.3$

$$= \text{Meat Quality Score}$$
<table>
<thead>
<tr>
<th></th>
<th>Ungraded</th>
<th>3 star</th>
<th>4 star</th>
<th>5 star</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Grinding beef</strong></td>
<td>Everyday quality</td>
<td>Better than Everyday</td>
<td>Premium quality</td>
<td></td>
</tr>
<tr>
<td><strong>Meat Quality Score</strong></td>
<td>&lt; 48</td>
<td>48 - 63</td>
<td>64 - 79</td>
<td>80+</td>
</tr>
<tr>
<td>Format</td>
<td>Name</td>
<td>Input</td>
<td>% or X if doubt?</td>
<td>Age</td>
</tr>
<tr>
<td>--------</td>
<td>------</td>
<td>-------</td>
<td>------------------</td>
<td>-----</td>
</tr>
<tr>
<td>% or X if doubt?</td>
<td>EPBI</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MF</td>
<td>Sex</td>
<td>M</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Y or Y/N</td>
<td>HGP</td>
<td>N</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Y/N</td>
<td>MFV</td>
<td>N</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Y/N</td>
<td>SIYr</td>
<td>N</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Y/N</td>
<td>RnFl</td>
<td>N</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight in Kg</td>
<td>HSCW</td>
<td>268</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AT/TS/TL/TT/TC/TX</td>
<td>Han g</td>
<td>TX</td>
<td></td>
<td></td>
</tr>
<tr>
<td>mm</td>
<td>Hum p</td>
<td>45</td>
<td></td>
<td></td>
</tr>
<tr>
<td>USDA measure</td>
<td>uoss</td>
<td>140</td>
<td></td>
<td></td>
</tr>
<tr>
<td>USDA measure</td>
<td>umb</td>
<td>220</td>
<td></td>
<td></td>
</tr>
<tr>
<td>mm</td>
<td>RbFt</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metered pH</td>
<td>UpH</td>
<td>5.58</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metered Temp C</td>
<td>Utm p</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Days Aged</td>
<td>Age</td>
<td>14</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Testing the MSA model

- Funding from DAFM – FIRM programme
- AUS – Ireland comparison
- Irish commercial sample
- Experiments to test factors
  - Ageing
  - Stimulation –LVES and HVES
  - Breed
  - Hanging method
  - Boning time –24 v 48h
AUS – IRL comparison

- “Matched” set of samples from Ireland and AUS – 18 carcasses from each country, 6 muscles from each carcass, 2 cooking methods
- AUS samples tasted by AUS and Irish consumers
- Irish samples tasted by Irish consumers
- Compare responses of AUS and Irish consumers
- Test fit of model to Irish beef and Irish consumers
Consumer testing

- Individual muscles removed and trimmed
- Samples prepared and frozen
- Cooked in standard way (grilled, roasted, yakiniku) to medium done
- Groups of 20 consumers (60 for roasts) – social clubs, sports clubs, charities etc.
- Rate for tenderness, juiciness, flavour, overall like
- Assign quality category = stars


**Tenderness**

Not tender | Very Tender

**Juiciness**

Not Juicy | Very Juicy

**Liking of flavour**

Dislike Extremely | Like Extremely

**Overall Liking**

Dislike Extremely | Like Extremely

Please tick [✓] one of the following to rate the quality of the beef sample you have just eaten:

Choose **one** only (you must make a choice)

- Unsatisfactory [ ]
- Good everyday eating quality [ ]
- Better than everyday eating quality [ ]
- Premium quality [ ]
Relationship between palatability scores and quality category

Scores for all palatability attributes increased with quality category
Considerable variability in quality for striploin, rump and round
Irish consumers v model

Irish Residuals (Ir-M)

Deviations from model significant only for grilled striploin and Yakiniku topside
Irish v AUS consumers

Differences (Ir-Au)

Deviations significant only for Yakiniku, rump and tenderloin
Ageing and stimulation – Effect on MQS

At 28 days LVES tended to improve MQS of striploin but reduced MQS for outside. Significant negative effect of ageing on OR.
Overall conclusions

• Irish beef fits model at least as well as AUS beef
• Model fits Irish consumers at least as well as AUS
  ▪ Irish consumers score beef in similar way to AUS consumers, but not identical (Irish more weight on flavour) and model may need optimising
  ▪ Model tested over wide range of factors with moderately large database - over 1100 samples
  ▪ Accounts for different factors reasonably well in most circumstances
  ▪ Some exceptions may be due to electrical inputs on line not accounted for
Success of MSA in AUS

Number of carcasses graded annually

No. of carcasses

Year

The Irish Agriculture and Food Development Authority
MSA grading pays

Average prices ($/kg, Real Dec'05)

The Irish Agriculture and Food Development Authority
What’s the future for meat quality grading?

- USDA model not appropriate since grading occurs at quartering
- Rapid methods (such as NIR) have promise but are also most likely to be applied at quartering
- MSA predictive model could be adopted
- May not be optimised for Irish beef
- MSA model also tested in NI, France, Poland – international effort to derive a European model
- Could include age, breed etc. from ID, genetics, NIR, images of loin etc.
Thank you for listening!