Challenges and Opportunities - Meat Quality

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Teagasc
Introduction
Teagasc

- National agency for research in agriculture and food (7 major research centres)
- Advice and training of farmers and food industry stakeholders
- To enable the highest standards of consumer safety, food quality and nutrition to be achieved in Irish food products.
The National Food Centre

Main Activities:
- Meat Technology
- Food Safety
- Market Studies
- Training
- Innovation Management
- Technology Transfer
- Consultation
Overview

- What is meat quality?
- Perception of quality
- What factors are known to affect it?
- What are the challenges and opportunities?
- Summary
What is meat quality?

- No universal definition
- Means different things to different people – between and also within countries/regions
- Different criteria at each stage of production chain
- Will change over time
Perception of quality
Producer

- Weight
- Conformation
- Fatness
- Feed efficiency
- Growth rate
Perception of quality
Primary Processor

- Cleanliness
- Weight
- Yield
- Conformation
- Fat content
- Sex
- Age

- Bruises etc
- pH
- Colour
- Marbling
- Traceability
Perception of quality
Secondary Processor

Fat content
WHC
pH
Yield
Traceability
Perception of quality
Consumer

INTRINSIC

At point of sale:
- Colour
- Fatness
- Drip
- Nutritional

On cooking:
- Aroma
- Shrinkage
- Exudate

On eating:
- Tenderness
- Juiciness
- Flavour

EXTRINSIC

- Safe
- Traceable
- Animal welfare
- Organic
- Outdoor reared
Factors affecting meat quality

Pre-slaughter
- Breed
- Genetic
- Sex
- Age
- Feeding
- Handling
- Stunning method

Post slaughter
- Stimulation
- Scalding/singeing
- Hanging method
- Chilling rate
- Ageing time
- Ageing method
- Packaging
- Cooking
Colour

Fat colour affected by feeding - grass fed = more yellow

Lean colour depends on oxidative state of myoglobin

Affected by total pigment content, feeding

Changes to production system affect acceptability
Tenderness

- Most important criterion for consumers
- Affected by many pre and post slaughter factors
- Two components - connective tissue and myofibrilar
Meat tenderness

- WB shear force
- Tenderisation
- Background toughness
- Time post mortem
# Background toughness

<table>
<thead>
<tr>
<th>Component</th>
<th>Affected by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collagen content</td>
<td>Breed, sex, age, genetics, production system</td>
</tr>
<tr>
<td>Collagen state</td>
<td>Age</td>
</tr>
<tr>
<td>Fibre type</td>
<td>Breed</td>
</tr>
<tr>
<td>Fibre size</td>
<td>Breed</td>
</tr>
<tr>
<td>IMF</td>
<td>Breed, feed, genetics</td>
</tr>
</tbody>
</table>
Post rigor tenderisation

- Caused by proteases
- Potential fixed at slaughter
- Post slaughter treatment to release potential
- May be genetic differences
- May be affected by feeding system/growth rate
- May be affected by packaging method
Juiciness

- Influenced by fat content
- Not related to total moisture content
- Ability to retain moisture during cooking
- Freezing/thawing have major effect
Flavour

- Maillard reaction - amino acids produce meaty flavour, lipids species effect
- Local tastes
- Fat plays important role - many volatiles are fat soluble
- Feeding - grass v concentrates
- Age - older animals have stronger flavour
- Ageing - more gamey flavour
- Packaging - oxidation of fats (PUFA more susceptible)
Manipulation of fatty acids

- More difficult in ruminants than monogastrics
- Grass fed beef and lamb has more PUFA, CLA
- Red clover increases PUFA
- Can be altered by feeding different fats in concentrates - though should be protected
- Proportion of PUFA decreases with fatness so leaner animals have higher P:S
## Summary of pre-slaughter factors

<table>
<thead>
<tr>
<th>Factor</th>
<th>Effect</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breed</td>
<td>Small</td>
<td>Duroc, Brahman</td>
</tr>
<tr>
<td>Genetics</td>
<td>Large</td>
<td>Hal, RN genes</td>
</tr>
<tr>
<td>Sex</td>
<td>Small</td>
<td>Boar odour</td>
</tr>
<tr>
<td>Age</td>
<td>Small</td>
<td>Cows</td>
</tr>
<tr>
<td>Feeding</td>
<td>Medium</td>
<td>Grass v Concentrates</td>
</tr>
<tr>
<td>Handling</td>
<td>Large</td>
<td>PSE/DFD</td>
</tr>
</tbody>
</table>
# Summary of post slaughter factors

<table>
<thead>
<tr>
<th>Factor</th>
<th>Effect</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stimulation</td>
<td>Variable</td>
<td>Cold toughening</td>
</tr>
<tr>
<td>Hanging method</td>
<td>Medium</td>
<td>Tenderness</td>
</tr>
<tr>
<td>Chilling rate</td>
<td>Large</td>
<td>Cold shortening</td>
</tr>
<tr>
<td>Ageing time</td>
<td>Large</td>
<td>Tenderisation</td>
</tr>
<tr>
<td>Ageing method</td>
<td>Small</td>
<td>Flavour</td>
</tr>
<tr>
<td>Packaging</td>
<td>Small</td>
<td>High oxygen</td>
</tr>
<tr>
<td>Cooking</td>
<td>Large</td>
<td>Tenderness, juiciness</td>
</tr>
</tbody>
</table>
Some opportunities and challenges for improving meat quality

- IMF—affects tenderness, juiciness and flavour, increased by concentrates, some breed differences, moderately heritable but correlated with overall fatness, marker genes etc.

- CHALLENGE - to increase IMF without increasing total fat, through breeds, genetics, feeding
Challenges (2)

Production systems – organic, outdoor, welfare friendly – generally small or negative effect on quality – strategies to improve quality

CHALLENGE - alternative, sustainable, verifiable and traceable systems that produce safe high quality meat products
Challenges (3)

Local/traditional breeds (species) – better quality?, characteristic qualities – niche markets

CHALLENGE - Characterise meat and products from local/traditional breeds and species, identify specific qualities - branded products, develop traceability systems
Challenges (4)

Healthier meat – modified fatty acids, meat products with beneficial fatty acids, neutraceuticals, natural ingredients, reduced salt, nitrate

CHALLENGE - develop production/processing strategies to produce meat with positive health benefits
Summary

- Quality becoming more important to consumers
- Many factors affect eating quality - whole chain approach essential
- Challenge to organise chain to produce consistent quality
- Offers opportunities to improve or offer choice
- Research must be directed to whole chain