Flavour and consumers - an international approach?

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Flavour and consumers - an international approach?

- Importance of flavour
- How can we study it?
- Results so far
- What can we deliver?
What is the role of flavour for consumers?
Consumer aspirations?

Quality attributes
- Search / Experience / Credence

Ranking 22 attributes from 15 papers

1. Origin  C
2. Price     S
3. Labels, brands, certification  S
4. Visible fat  S
5. Flavour  E
6. Animal welfare  C
7. Production system  C
8. Freshness, shelf-life  E
9. Natural, organic  C
10. Tenderness  E
11. Health, nutrition  C
12. Meat colour  S

Henchion et al., Meat Science, 2016
Prediction of overall acceptability of beef by tenderness and flavour
Grilled sirloin: German, Spanish and British consumers

Regression coefficients (P < 0.001)

<table>
<thead>
<tr>
<th>Consumer Country</th>
<th>Tenderness coefficient</th>
<th>Flavour coefficient</th>
<th>$R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>German</td>
<td>0.50</td>
<td>0.50</td>
<td>0.99</td>
</tr>
<tr>
<td>Spanish</td>
<td>0.40</td>
<td>0.59</td>
<td>0.99</td>
</tr>
<tr>
<td>British</td>
<td>0.40</td>
<td>0.59</td>
<td>0.99</td>
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</tbody>
</table>

Oliver et al., Meat Science 2006
### MSA consumer data from different countries

Relative contribution of flavour liking (FL) and tenderness (TE) to satisfaction in grilled beef for different consumer countries

<table>
<thead>
<tr>
<th></th>
<th>FL &gt; TE</th>
<th>FL = TE</th>
<th>FL &lt; TE</th>
</tr>
</thead>
<tbody>
<tr>
<td>N. Ireland</td>
<td>Australia</td>
<td>Japan</td>
<td></td>
</tr>
<tr>
<td>Ireland</td>
<td>France</td>
<td></td>
<td></td>
</tr>
<tr>
<td>USA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poland</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S. Africa</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Rare, medium or well done beef - same effect
- Cooking method - flavour liking even more important for RST than GRL

Polkinghorne personal communication
How can we study the flavour component of consumer liking?
Using flavour and aroma terms only
- trained panel and consumers

Aroma, Flavour and Aftertaste - External Preference Map
(PC2 vs PC3)

-1 -0.5 0 0.5 1
PC2 (17.9%)
PC3 (12.3%)
Using flavour and aroma terms only - adding classes of volatiles

With other flavour volatiles
Aroma, Flavour and Aftertaste - External Preference Map (PC2 vs PC3)

With other flavour precursors and meat quality measurements
Marker compounds

- Clear associations between volatiles, precursors and meat quality measurements
- Volatile compounds from the same overall formation pathway are often associated
- Groups of volatiles are associated with sensory attributes, and thus may be markers for flavour
- Marker compounds - link to quality but may not be causative - easier to measure.
  - Are Strecker aldehydes markers for flavour liking?
International approach

Common protocols for

- Consumer panels - MSA
- Volatiles - marker compounds
- Quality assurance
Results so far
Results so far

Effect of factors on flavour volatiles, e.g.

- Ageing, USDA grade, diet, fat content
- Packaging, muscle, enhancement, ageing, cooking method
- Comparison and validation of manual and automatic methods
- Quality assurance
- Effect on precursors
Effect of cooking method

- Quantities relative to sirloin = 1
- Many sig effects of cooking method.
- Many but not all compounds in a group follow a pattern.

**Ketones**

<table>
<thead>
<tr>
<th>Compound</th>
<th>Casserole</th>
<th>Roast</th>
<th>Grill</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-methyl-2-pentanone (*)</td>
<td>1.0</td>
<td>0.3</td>
<td>0.5</td>
</tr>
<tr>
<td>3-methyl-2-pentanone (***</td>
<td>1.2</td>
<td>0.8</td>
<td>1.0</td>
</tr>
<tr>
<td>2-heptanone (***</td>
<td>1.0</td>
<td>0.8</td>
<td>1.0</td>
</tr>
<tr>
<td>5-methyl-3-hexanone (**)</td>
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**Strecker aldehydes**

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**Sulphur compounds**

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<th>Roast</th>
<th>Grill</th>
</tr>
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<tbody>
<tr>
<td>dimethyl disulphide (***</td>
<td>1.0</td>
<td>0.3</td>
<td>0.5</td>
</tr>
<tr>
<td>methyl propyl disulphide (***</td>
<td>1.0</td>
<td>0.3</td>
<td>0.5</td>
</tr>
<tr>
<td>dimethyl trisulphide (***</td>
<td>1.0</td>
<td>0.3</td>
<td>0.5</td>
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</tbody>
</table>
Effect of cooking method

- Different cooking methods cause very large changes in the balance of aroma compounds.

<table>
<thead>
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<th>Roast (inside)</th>
<th>Grill (inc. outside)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strecker aldehydes</td>
<td>Low</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Di/tri sulphides</td>
<td>High</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Ketones</td>
<td>High</td>
<td>High</td>
<td>Low</td>
</tr>
</tbody>
</table>

- Likely to cause large flavour differences between casseroled beef, roast (internal) and grilled beef.
- Due to Aw, oxidation and temperature/time?
Flavour perception

- Base cause
  - Age/maturity?
  - Breed/genetics?
  - Diet
  - Marbling, IMF
  - pH
  - pH/T decline
  - Ageing
  - Muscle
  - Cooking method
  - Contamination

- Formation pathways
  - Proteolysis
  - Glycolysis
  - ATP / IMP breakdown
  - Pentose phosphate pathway
  - Lipid oxidation
  - Impact of pro-oxidants and antioxidants

- Flavour precursors
  - Amino acids
  - H₂S
  - Sugars
  - Fatty acids
  - Nucleotides
  - Carotenoids

- Flavour
  - ODOR VOLATILES
  - TASTE (including UMAMI)
  - FLAVOUR RELEASE

- Flavour as perceived by the consumer
Flavour perception

Base cause
- Age/maturity?
- Breed/genetics?
- Diet
- Marbling, IMF
- pH
- pH/T decline
- Ageing
- Muscle
- Cooking method
- Contamination

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Flavour
- ODOR VOLATILES
- TASTE (including UMAMI)
- FLAVOUR RELEASE

FLAVOUR as perceived by the consumer
What can we deliver?
What can we deliver?

Understanding of cause and effect

Optimise flavour potential and consistency
- Flavour precursors
- pH

Overcome flavour deficits
- Added ingredients
- Changed conditions
Conclusions

Changes in volatiles reflect changes in flavour

Consumer liking is linked to:
- tenderness, juiciness, sweet flavour
- “Marker compounds” for flavour liking:
  - “Maillard” odour compounds
  - Sugars and amino acids in raw meat

Understanding beef flavour is possible!
- Opportunity to optimise flavour and mitigate deficits
Thank you!

- Colleagues and students at AFBI and TTU, e.g.
  - Irene Chong
  - Terence Hagan
  - Jerrad Legako

- Birkenwood, Teys, TTU and MLA for funding, e.g.
  - Rod Polkinghorne
  - Tom Maguire
  - Mark Miller

- UCC for PhD
  - Maurice O’Sullivan
  - Joe Kerry

- You for listening!