Intramuscular fat and dry matter of beef are correlated with untrained consumer scores

Bonny S.P.F., 1 Legrand I. 2, Polkinghorne R. J. 3, Gardner G.E. 1, Pethick D.W. 1, Hocquette J.F., 4

1 School of Veterinary and Biomedical Science, Murdoch University, Murdoch, Western Australia 6150, Australia
2 Institut de l’Elevage, Service Qualité des Viandes, MRAL, 87060 Limoges Cedex 2, France;
3 431 Timor Road, Murrurundi, NSW 2338, Australia;
4 INRA-VetAgro Sup, UMRH 1213 Theix, 63122 Saint Genes Champanelle, France;
Outline

• Eating quality is important

• Hypotheses
  – IMF
  – Iron
  – Moisture content

• Experimental design
  – Untrained consumer panels
  – Linear mixed effects model

• Results and conclusions
  – IMF and moisture content can predict eating quality
Global Meat Consumption
Global Meat Consumption
Which is better?
Hypotheses
IMF Improves Eating Quality

Increasing sensory scores
Iron is positively correlated with IMF

High Iron = High IMF
Moisture content is negatively correlated with IMF

Low moisture, high IMF

High moisture, low IMF
Design
18 x Cattle

Cross-breed Steers
Aged 5 and 21 days

18 x Cattle

6 x Dairy Cows
6 x Beef Cows
3 x Young Bulls
3 x Heifers
Aged 7 days
### Biochemical Analysis

<table>
<thead>
<tr>
<th></th>
<th>N=213</th>
<th>Mean</th>
<th>Std Dev</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lipid (%)</td>
<td></td>
<td>3.0</td>
<td>2.6</td>
<td>0.2</td>
<td>19.5</td>
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<tr>
<td>H2O (%)</td>
<td></td>
<td>73.3</td>
<td>1.8</td>
<td>62.1</td>
<td>76.6</td>
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<tr>
<td>Iron (ug/g)</td>
<td></td>
<td>17.2</td>
<td>4.1</td>
<td>8.1</td>
<td>30.3</td>
</tr>
</tbody>
</table>
6 Muscles

- Outside
- Topside
- Rump
- Striploin
- Tenderloin
- Oysterblade
6 Muscles

- Outside
- Topside
- Rump
- Striploin
- Tenderloin
- Oysterblade

X 10 samples
Taste Panels

6 Muscles

- Outside
- Topside
- Rump
- Striploin
- Tenderloin
- Oysterblade

X 10 samples

540 Consumers
6 Muscles

- Outside
- Topside
- Rump
- Striploin
- Tenderloin
- Oysterblade

Taste Panels

X 10 samples

Untrained

540 Consumers
Taste Panels

6 Muscles
- Outside
- Topside
- Rump
- Striploin
- Tenderloin
- Oysterblade

Taste Panels
Untrained

X 10 samples

540 Consumers
X 6 Samples
Taste Panels

- Scored for
  - Tenderness
  - Juiciness
  - Flavour
  - Overall Liking

Scores then weighted and combined into a single MQ4 value:

\[
\text{MQ4 score} = \text{Tenderness} \times 0.3 + \text{Juiciness} \times 0.1 + \text{Flavour} \times 0.3 + \text{Overall Liking} \times 0.3
\]
Statistical Analysis
Linear mixed effects model

– Base model
  • Fixed Effects
    – Source country
    – Days aged
    – Doneness
    – Muscle
  • Random Term
    – Animal I.D.

– Covariates
  • Intramuscular Fat %
  • Moisture content
  • Heme iron
Statistical Analysis

Linear mixed effects model

- Base model
  - Fixed Effects
    - Source country
    - Days aged
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    - Muscle
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    - Animal I.D.

- Covariates
  - Intramuscular Fat %
  - Moisture content
  - Heme iron

Within Muscle
Statistical Analysis

Linear mixed effects model

- Base model
  - Fixed Effects
    - Source country
    - Days aged
    - Doneness
  - Random Term
    - Animal I.D.

- Covariates
  - Intramuscular Fat %
  - Moisture content
  - Heme iron

Within Muscle
Results
Average MQ4 Score for doneness within country and ageing period

Australia
Aged 5 days
Medium
Australia
Aged 21 days
Medium
France
Aged 7 days
Medium
France
Aged 7 days
Rare

Increasing MQ4
Average MQ4 Score for doneness within country and ageing period

Increasing MQ4

Australia Aged 5 days Medium
Australia Aged 21 days Medium
France Aged 7 days Medium
France Aged 7 days Rare

5.5
Average MQ4 Score for each muscle

Increasing MQ4

Outside | Oysterblade | Rump | Striploin | Tenderloin | Topside
Average MQ4 Score for each muscle

- Outside
- Oysterblade
- Rump
- Striploin
- Tenderloin
- Topside

Increasing MQ4

42.6
IMF and Flavour Across Muscle

Increasing Flavour

IMF
IMF and Flavour
Across Muscle

Increasing Flavour

IMF

34.5
IMF and Flavour

Increasing Flavour Within Muscle
## Magnitude of Impact

Muscle type unknown

<table>
<thead>
<tr>
<th></th>
<th>IMF (range: 0.23-9 %)</th>
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<tbody>
<tr>
<td>Tenderness</td>
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<tr>
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Magnitude of Impact
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<th>IMF (range: 0.23-9 %)</th>
<th>H2O (range: 70-77 %)</th>
<th>Iron (range: 10-25 ug/g)</th>
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<tr>
<td>Tenderness</td>
<td>56.8</td>
<td>28.8</td>
<td>-</td>
</tr>
<tr>
<td>Juiciness</td>
<td>39</td>
<td>20.4</td>
<td>12.1</td>
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<tr>
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<td>34.5</td>
<td>20</td>
<td>9.5</td>
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<td>Overall Liking</td>
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<td>23.5</td>
<td>11.5</td>
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# Magnitude of Impact

## Muscle type known

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Conclusion
Hypothesis – muscle unknown

Due to their relationships with IMF

• Iron content will be positively correlated with Flavour scores

• Moisture content will be negatively correlated with Flavour scores
Hypothesis – muscle known

Due to their relationships with IMF

• Iron content will be positively correlated with Flavour scores

• Moisture content will be negatively correlated with Flavour scores
Therefore

• Heme iron content adds little value to eating quality prediction where cut is known

• However IMF and moisture content will have an impact
Therefore

• Heme iron content adds little value to eating quality prediction where cut is known

• However IMF and moisture content will have an impact
Acknowledgements

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