

REIMS (Rapid Evaporative Ionisation Mass Spectrometry) prediction of beef sensory quality and its relationships to fat level

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INTERNATIONAL
MEAT RESEARCH
3G FOUNDATION



What is REIMS (Rapid Evaporative Ionization Mass Spectrometry)

- **Ambient ionization mass spectrometry** technique
- **No sample preparation & No chromatography & Real-time analysis**

iKnife
Electrosurgical knife



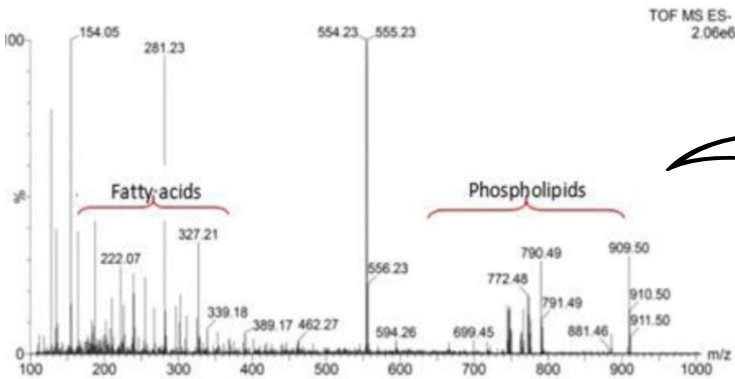
Q-TOF-MS
Quadrupole
Time-of-Flight
Mass Spectrometer

How REIMS works ?

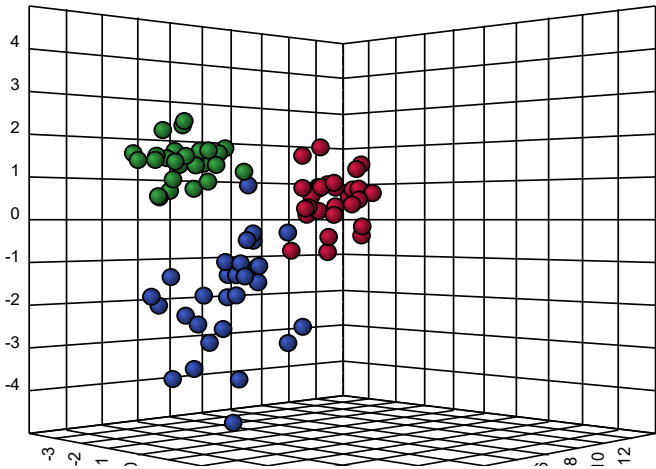
Sampling



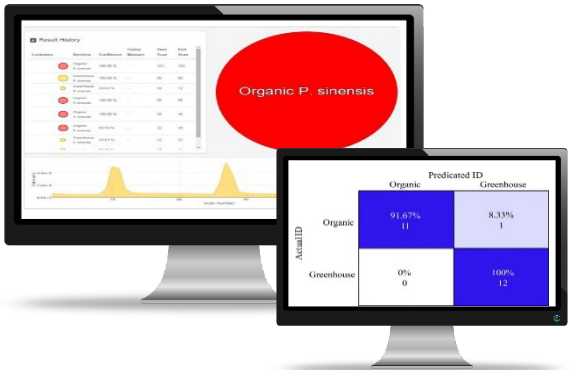
Mass Spectrum



Model generation



Real time recognition



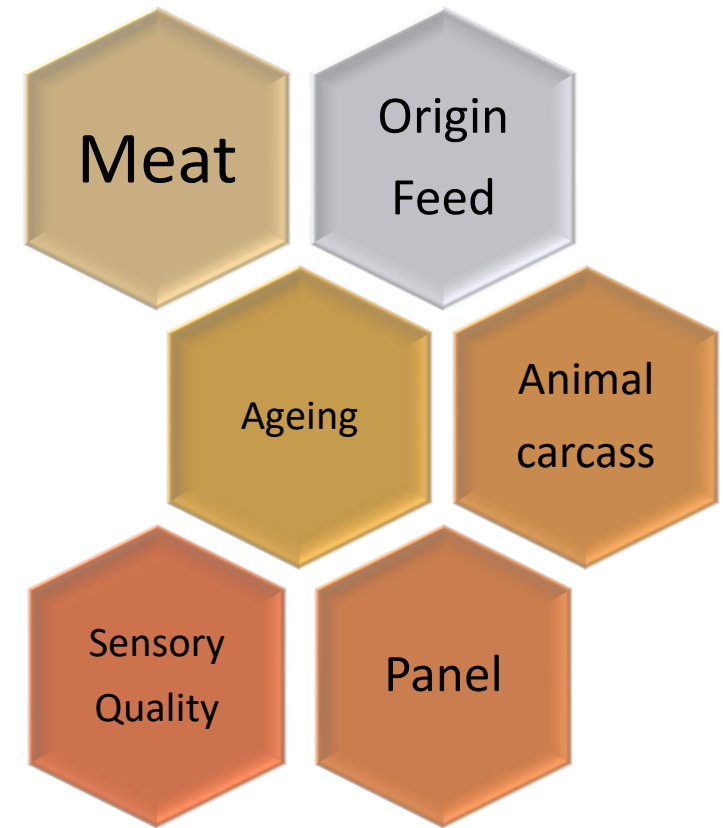
Objective & Hypothesis

- REIMS has a potential to classify meat according to **sensory quality evaluated by untrained consumer**

Lipid molecules tend to be the predominant components observed in a REIMS fingerprint

(Birse, 2021)

- Greater efficacy for **lipid-dominated traits** such as **flavour**



Animals

- 29 Angus x Salers crossbreed animals
- 15 females & 14 castrated males
- Pasture & grass feeding



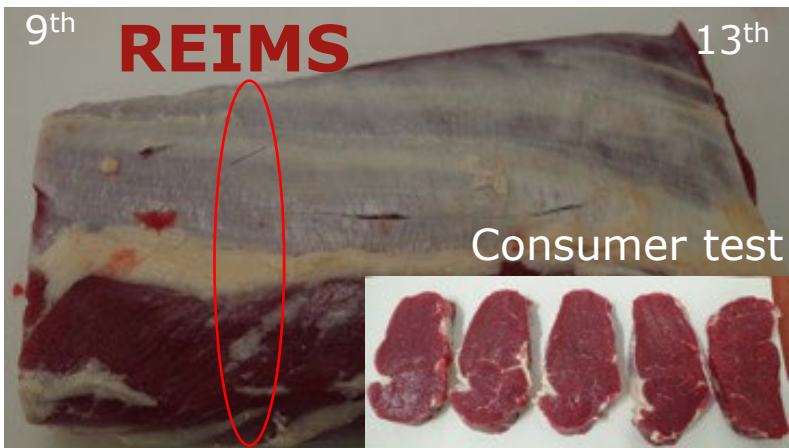
The animal production was coordinated by Sophie Prache

Meat samples

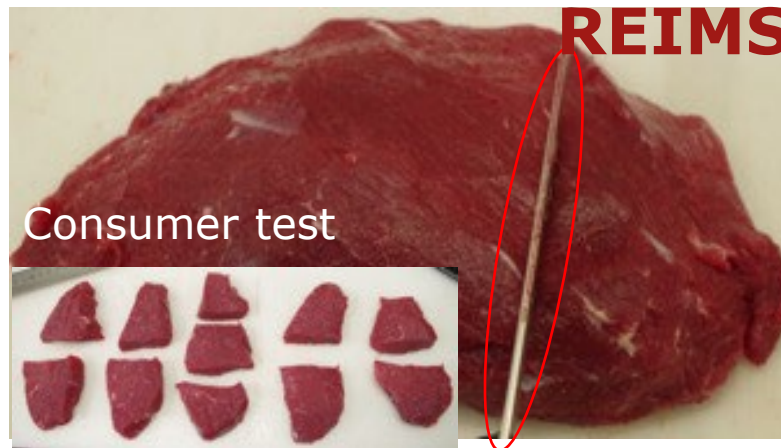
- 29 Loin (*m. longissimus dorsi et thoracis*)
- 58 Bolar blade (*m. triceps brachii caput longum*)
- 29 Internal flank plate (*m. obliquus internus abdominis*)



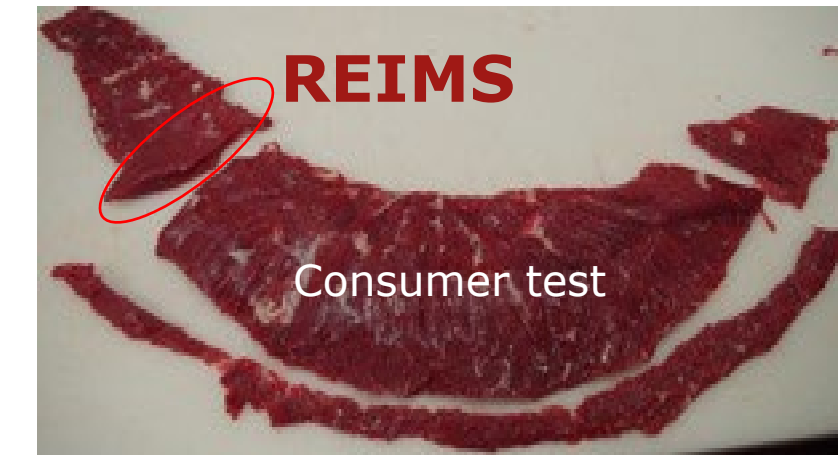
Loin



Bolar Blade



Internal Flank Plate



Methods

■ Sensory quality

- Untrained consumers
Flavor liking (0-100)
- Trained panels
Typical flavor (0-9) & Abnormal flavor (0-9)

■ Fat composition

- Intramuscular fat content (IMF), marbling, fatty acid (FA)

Statistical analysis

■ OPLS-DA

Orthogonal Partial Least Squares – Discriminant Analysis



Sensory quality – Consumer Flavor liking

Flavor liking scale: 0-100

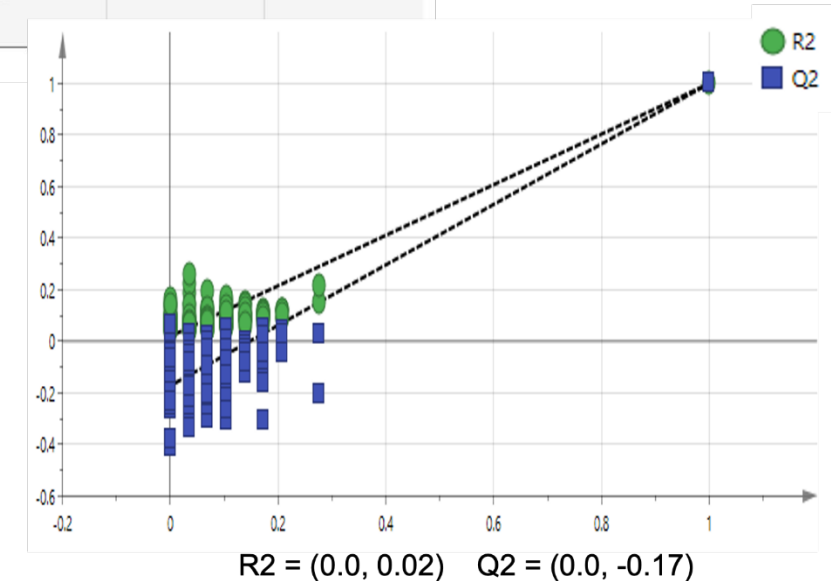
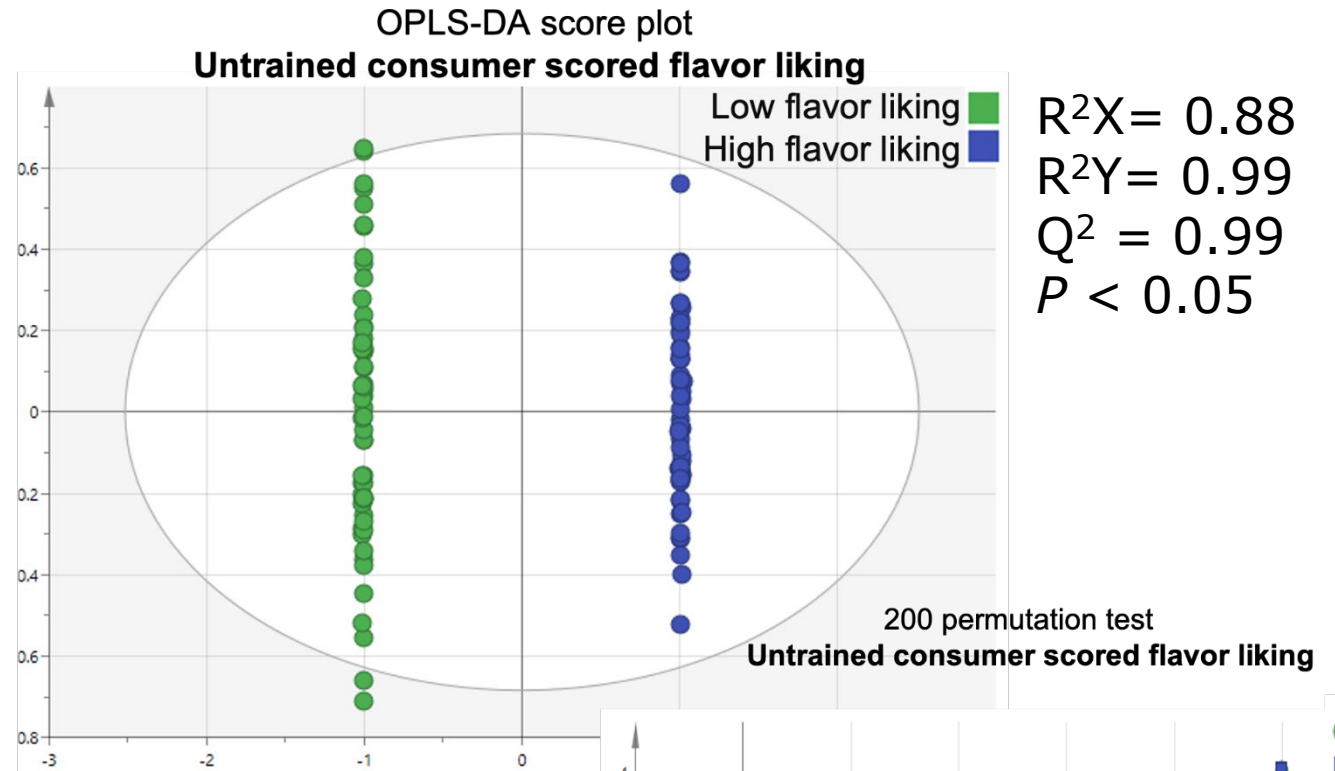
Flavor liking score: 31-97 (n=116)

Binary class

Low flavor liking: 27-66 (n=58)

High flavor liking: 67-97 (n=58)

REIMS classifies boar taint pork with an accuracy of 98%
- Verplanken et al., 2017



Sensory quality – Trained Panel Typical & Abnormal Flavor

Flavor scale: 0-10

Flavor score: 5 - 8; 8 - 9 (n=29)

Binary class

Typical Flavor

Low: 5.81–6.75 (n=15)

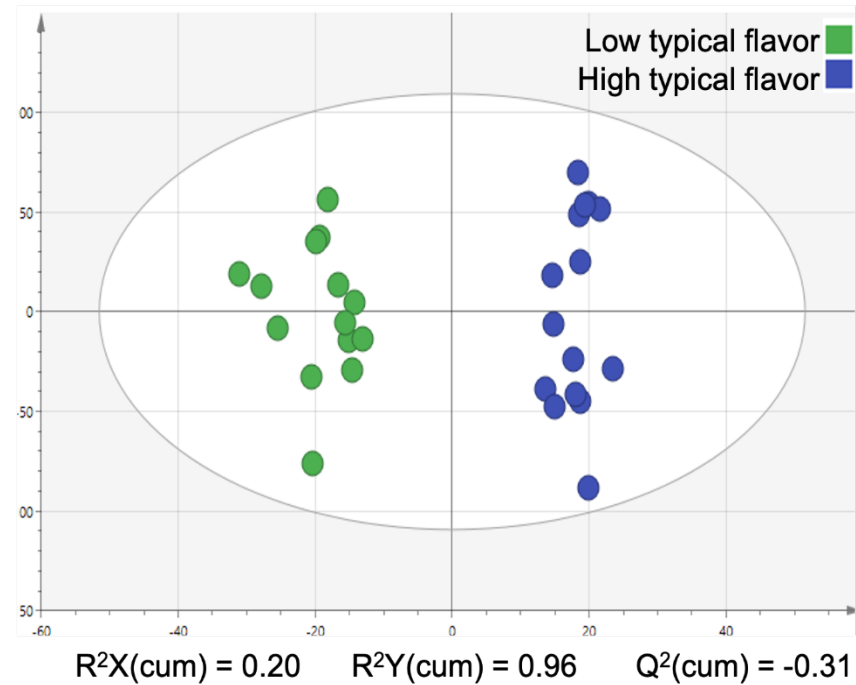
High: 6.77–7.8 (n=14)

Abnormal Flavor

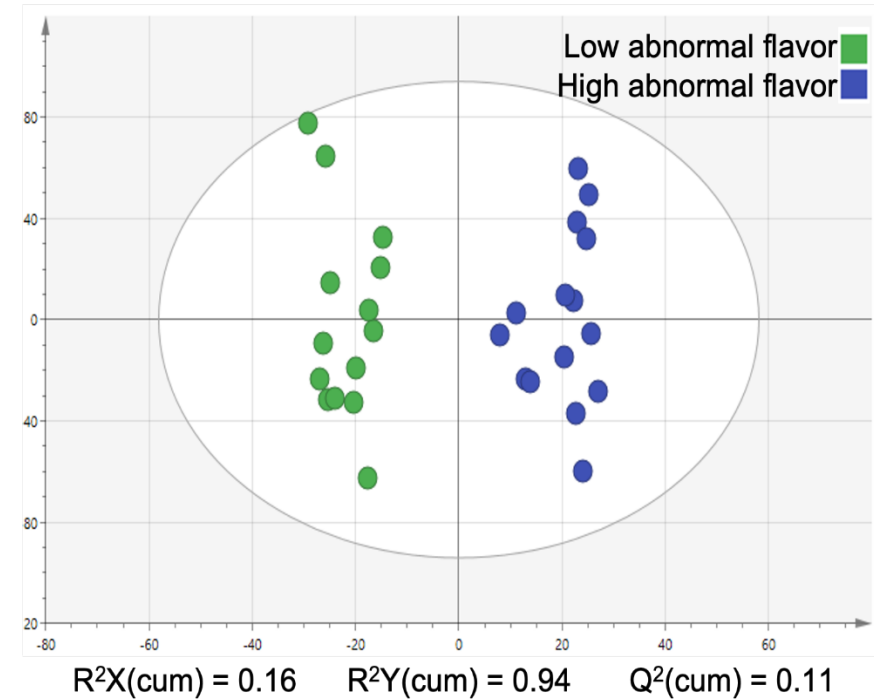
Low: 9.34–9.72 (n=15)

High: 9.75–9.95 (n=14)

Trained panel scored typical flavor



Trained panel scored abnormal flavor



High separation in spite of low sample variance

- Distinct metabolic profiles associated with different flavour intensities

Correlation between flavor and fat content



REIMS can differentiate flavour based on its intensity, is that because beef samples with different intensity flavour have different fat content?

2% to 56% of the variation in flavor could be explained by IMF content (Hocquette et al., 2011)

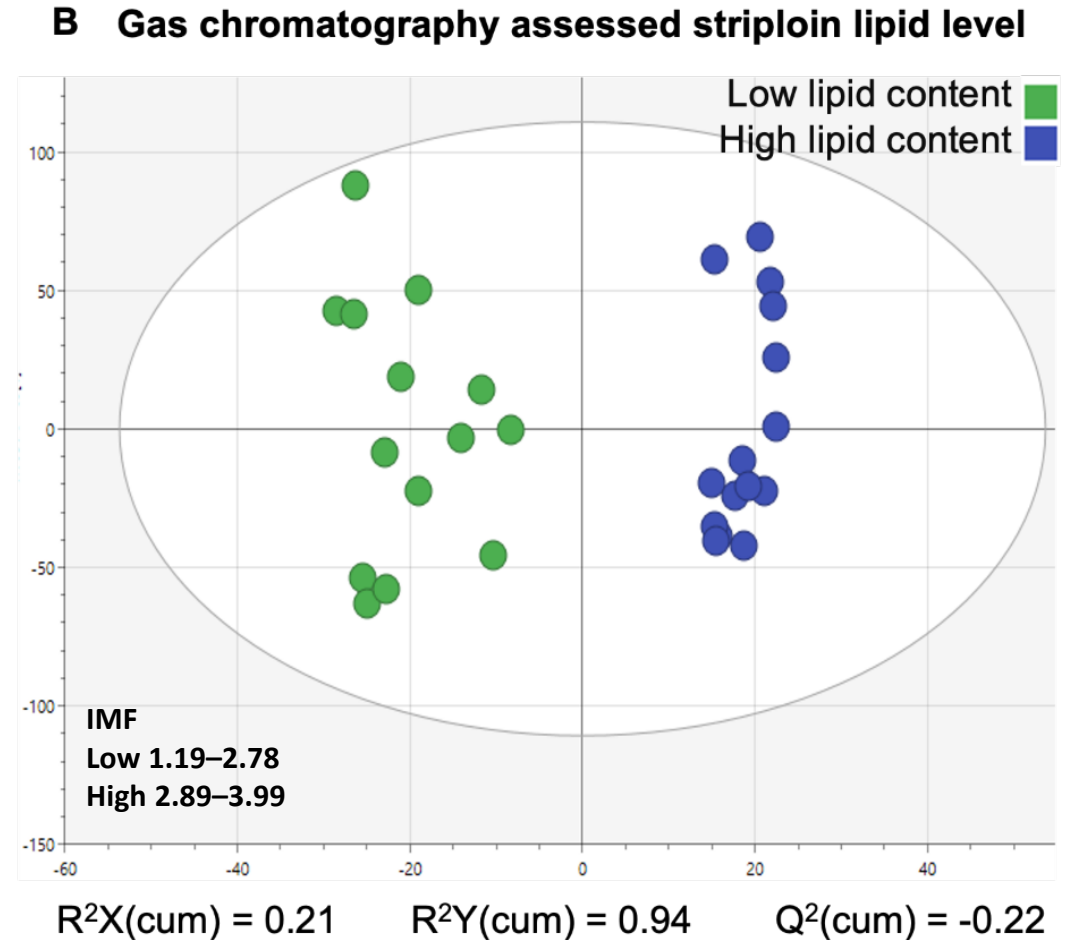
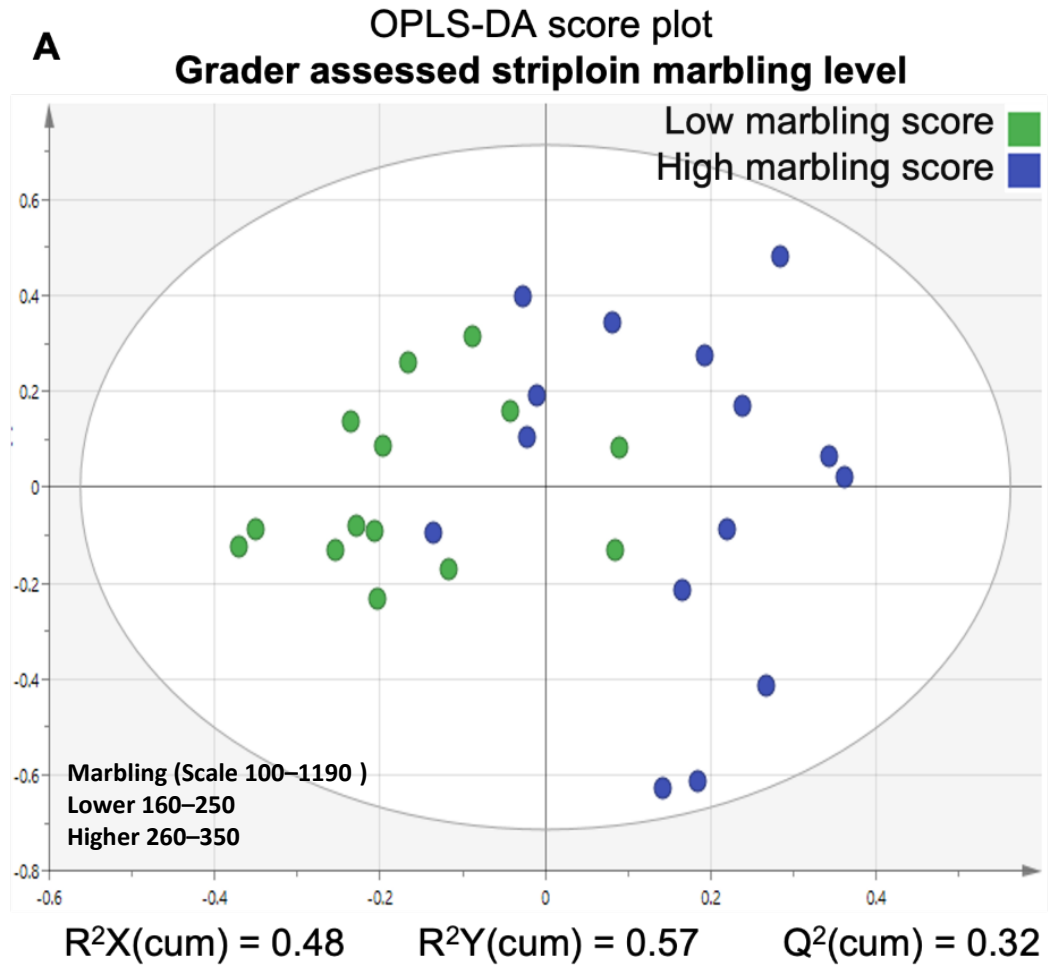
Panel
Typical & Abnormal
Flavor

~~IMF~~
~~Marbling~~

Consumer
Flavor Liking

Lean beef – Flavor might be less associated with fat content

Fat level – Total IMF & Marbling

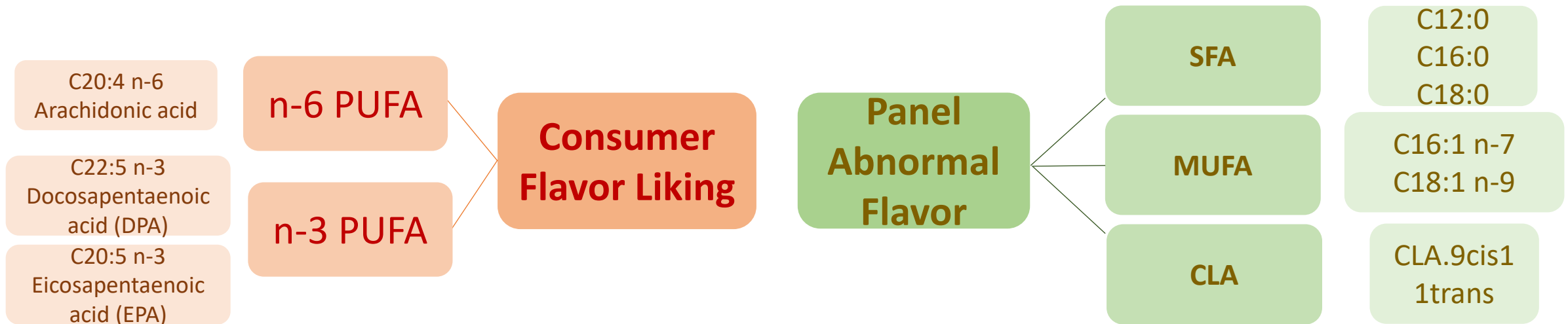


REIMS can detect variations in metabolites between meats of different fat content

Correlation between flavor and FAs

? Where does flavour come from ?

REIMS fingerprints
are largely from
lipid species
(Birse, 2021)



Lean meat, flavour may be less affected by total fat content, instead, it is more associated with specific Lipids

Conclusion

- REIMS capacity for accurate classification in meat quality **varies** in different characteristics
- REIMS has a great potential to classify meat according to **sensory quality**
- Greater efficacy for **lipid-related traits** such as **flavour**
- REIMS accurate classification of flavor may result from the correlation between specific flavor attributes and certain fatty acids.
- **Flavour may be more associated with lipid species**

Acknowledgement

Jean-François Hocquette (INRAE): Project supervision

Nigel Scollan & Nick Birse (Queen's University Belfast): REIMS

Isabelle Legrand (IDELE): Consumer sensory analysis

Marie-Pierre Ellies-Oury (INRAE): Panel sensory analysis

Sophie Prache (INRAE): Animal experiment



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