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

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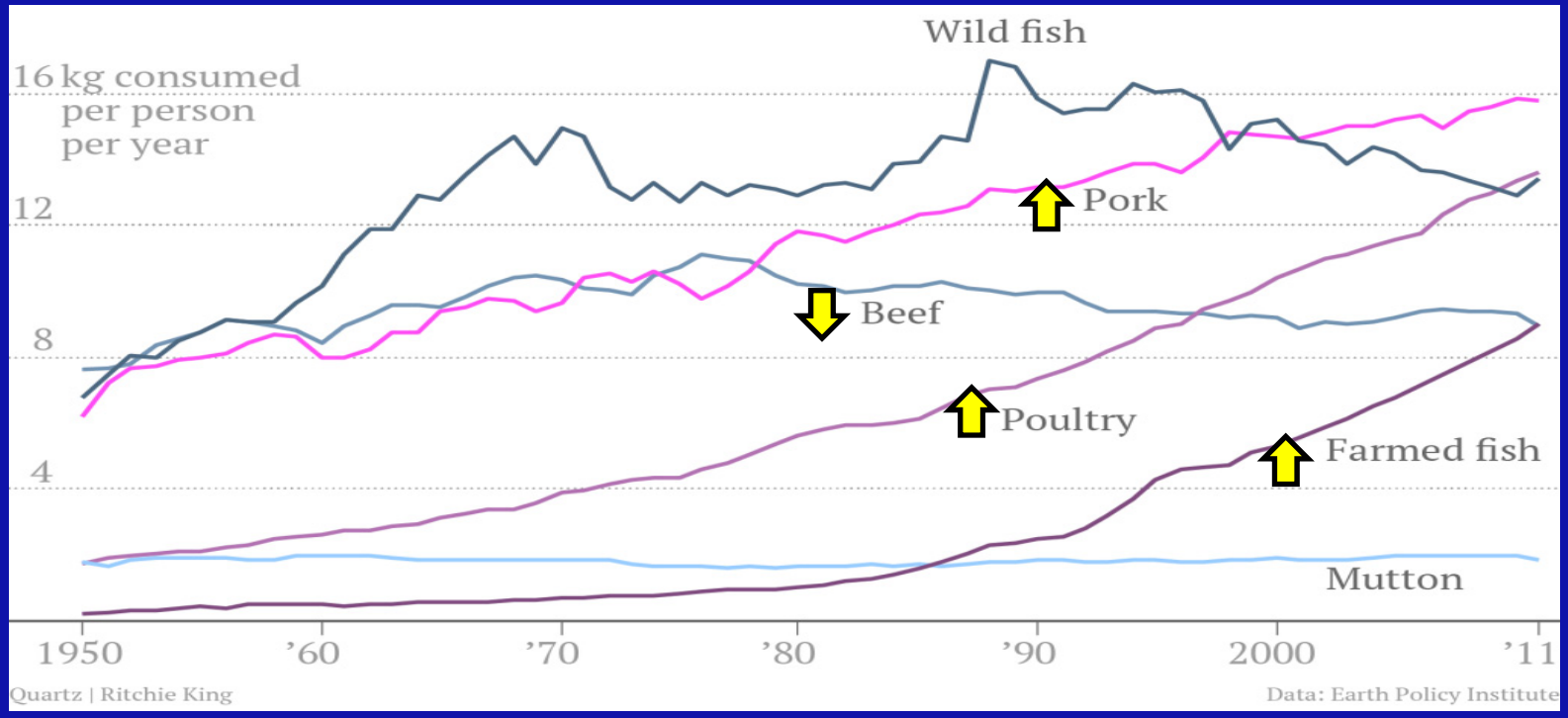
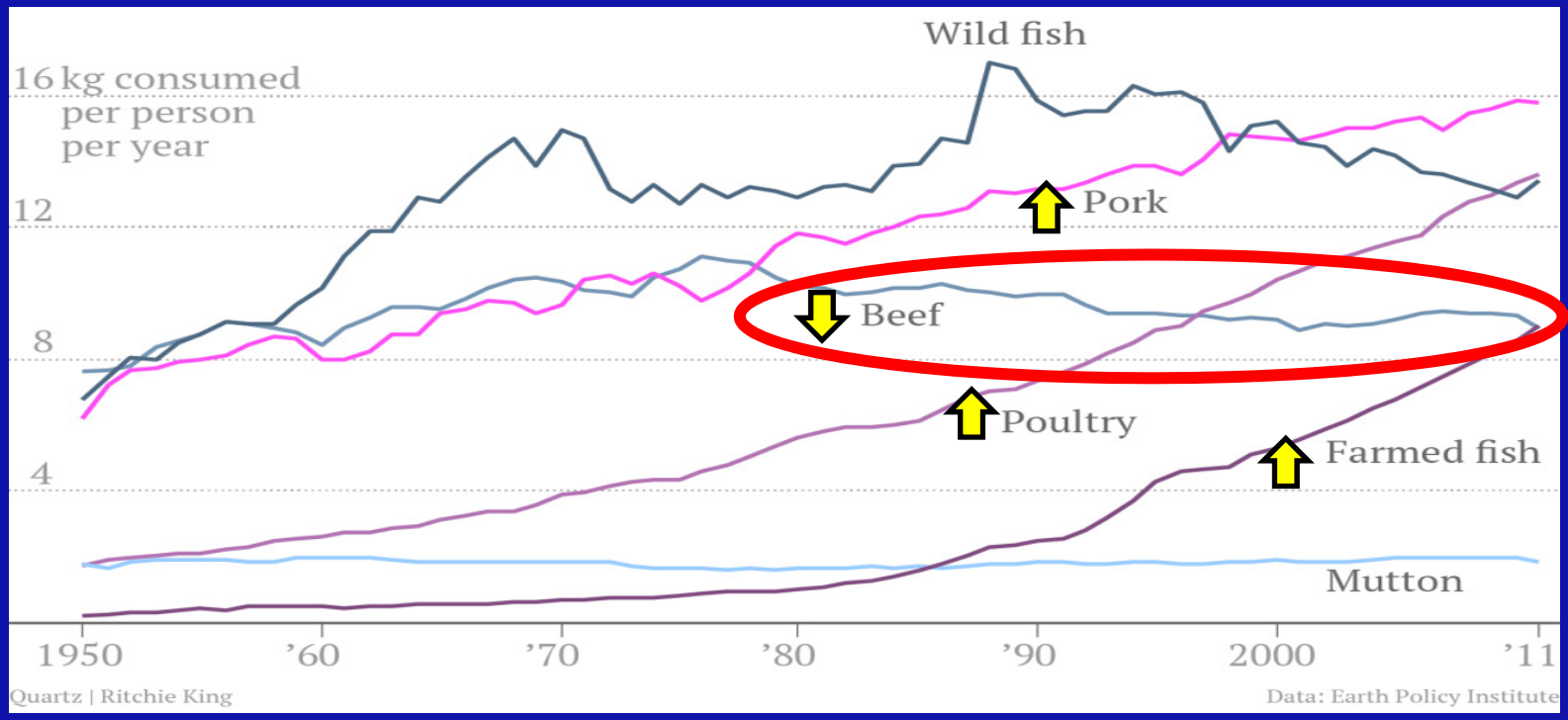
Outline

- 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

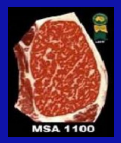
Increasing sensory scores

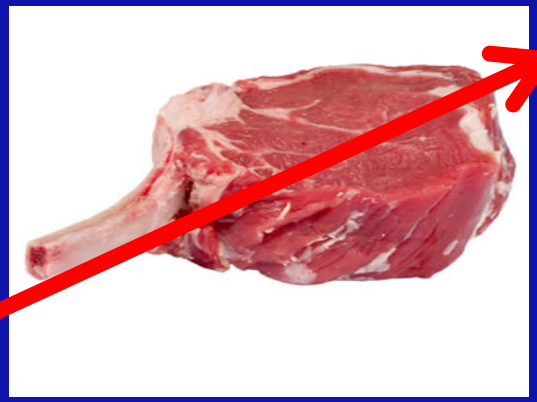
Iron is positively correlated with IMF

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

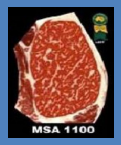
6 x Beef Cows

3 x Young Bulls

3 x Heifers

Aged 7 days

Biochemical Analysis

N=213	Mean	Std Dev	Minimum	Maximum
Lipid (%) 	3.0	2.6	0.2	19.5
H20 (%)	73.3	1.8	62.1	76.6
Iron (ug/g)	17.2	4.1	8.1	30.3

Taste Panels

6 Muscles

•Outside

•Topside

•Rump

•Striploin

•Tenderloin

•Oysterblade

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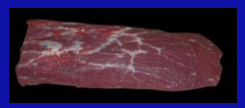

•Oysterblade

X 10 samples

Taste Panels

6 Muscles

- Outside

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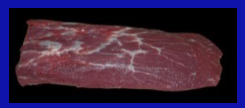


- Oysterblade

X 10 samples

540 Consumers

Taste Panels

6 Muscles

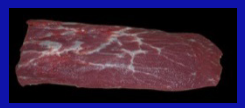
- Outside

- Topside

- Rump

- Striploin

- Tenderloin



- Oysterblade

X 10 samples

Untrained

540 Consumers

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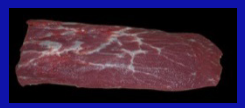

•Oysterblade

X 10 samples

Untrained

540 Consumers

X 6 Samples

Taste Panels

- Scored for
  - Tenderness 0 ——— 100
  - Juiciness 0 ——— 100
  - Flavour 0 ——— 100
  - Overall Liking 0 ——— 100
- Scores then weighted and combined into a single MQ4 value

Tenderness x 0.3
+
Juiciness x 0.1
+
Flavour x 0.3
+
Overall Liking x 0.3

MQ4 score

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

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    Intramuscular Fat %
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    Moisture content
  -
    Heme iron

Within Muscle

Statistical Analysis

Linear mixed effects model

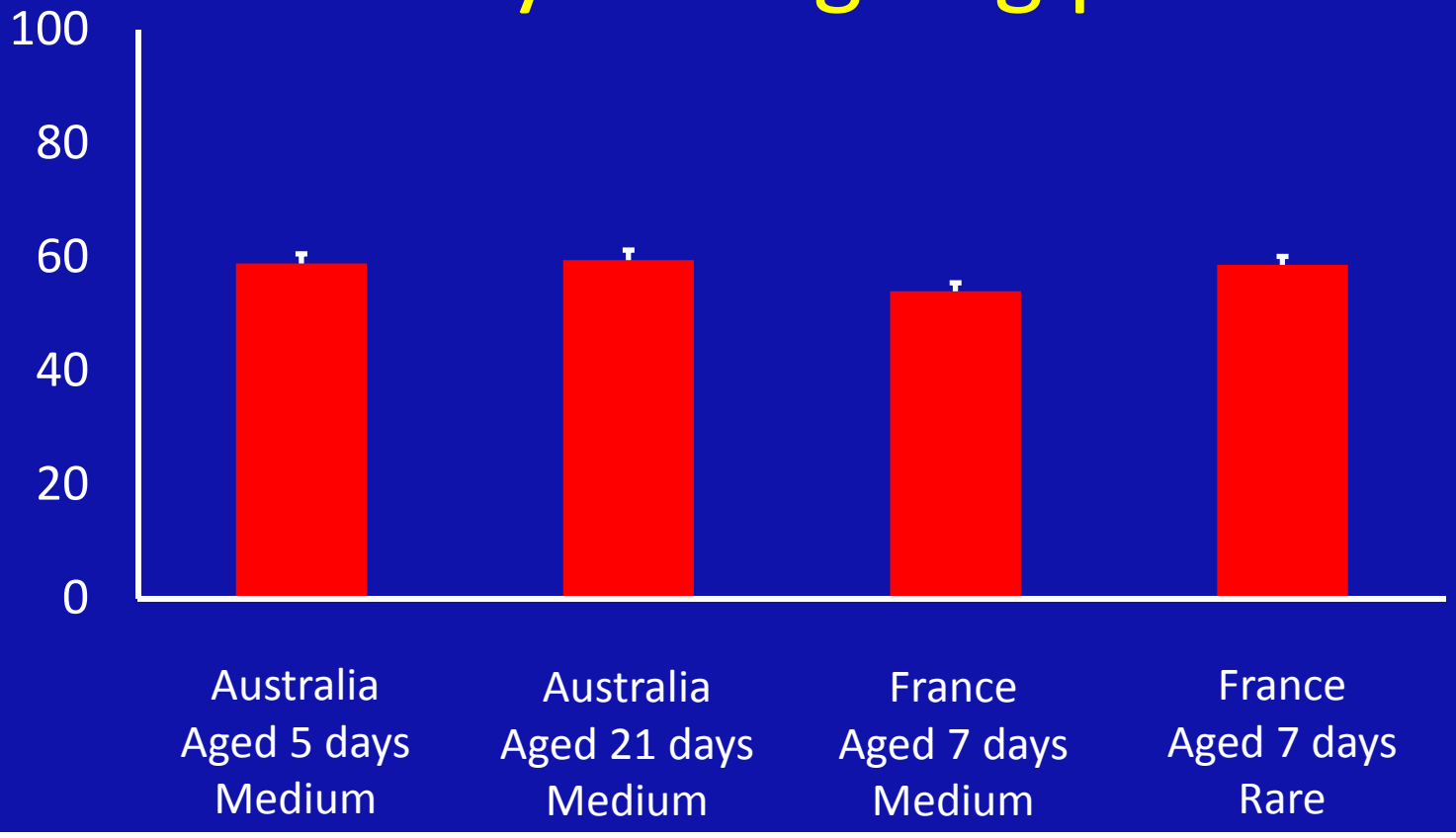
- Base model
  - Fixed Effects
    - Source country
    - Days aged
    - Doneness
    - M[illegible]e
  - Random Term
    - Animal I.D.
- Covariates
  -
    Intramuscular Fat %
  -
    Moisture content
  -
    Heme iron

Within Muscle

Results

Average MQ4 Score for doneness within country and ageing period

Increasing MQ4



Average MQ4 Score for doneness within country and ageing period

Increasing MQ4

100
80
60
40
20
0

5.5

Australia Aged 5 days Medium

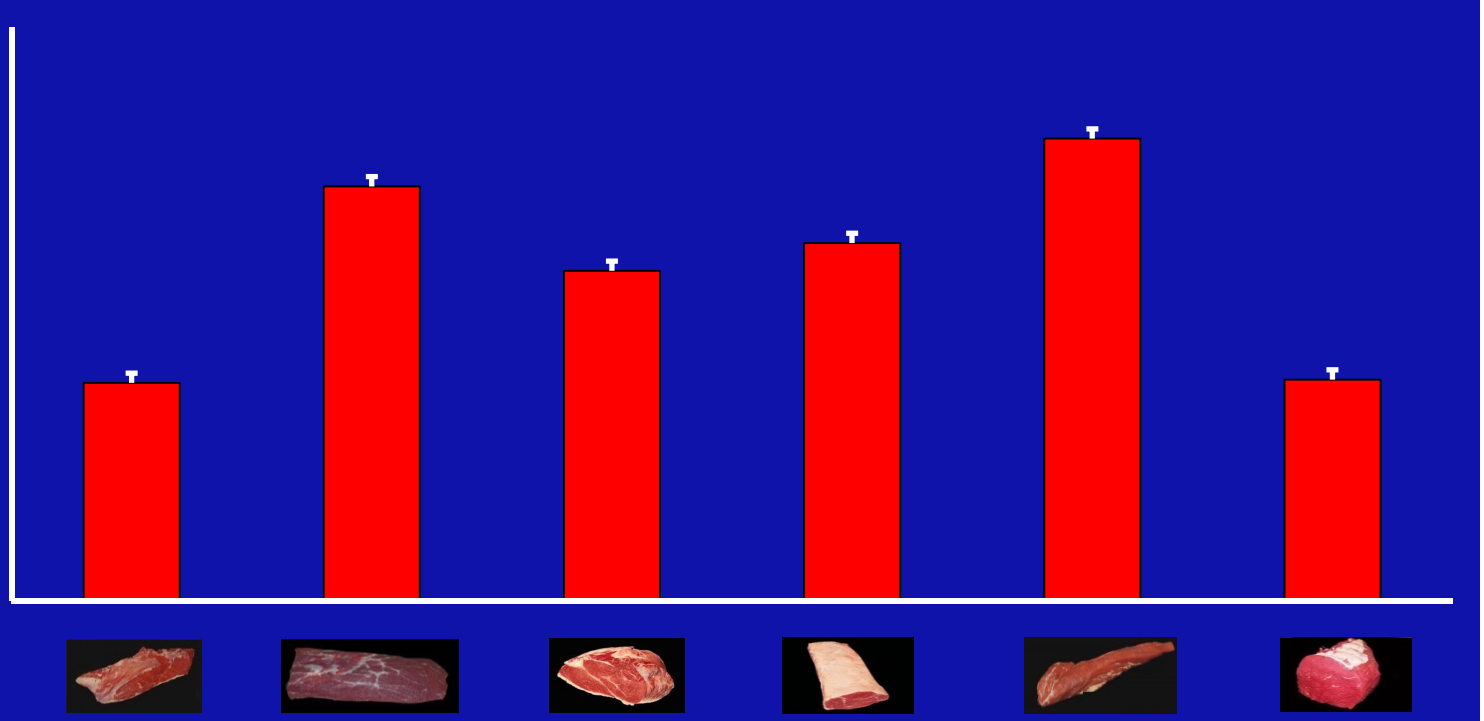
Australia Aged 21 days Medium

France Aged 7 days Medium

France Aged 7 days Rare

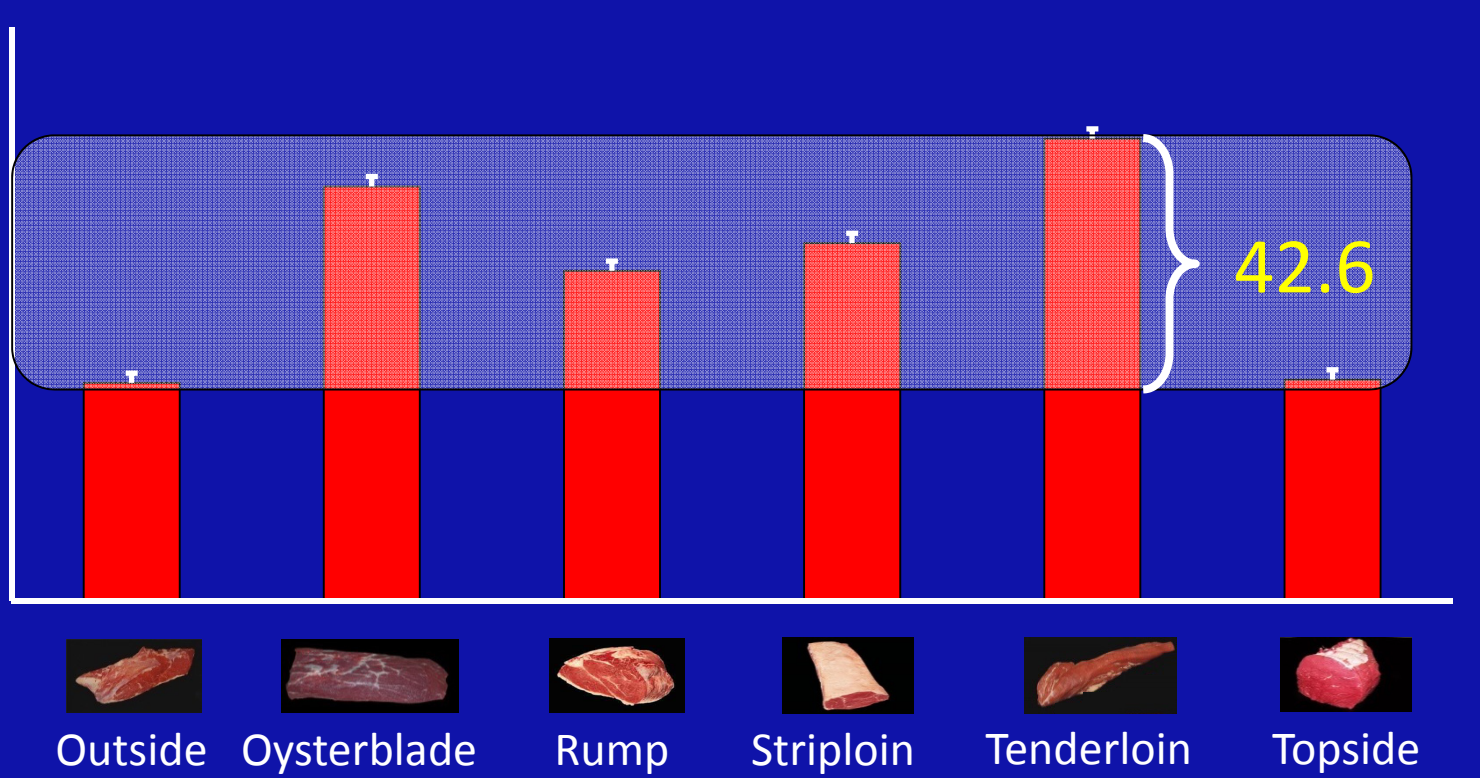
Average MQ4 Score for each muscle

Increasing MQ4



Average MQ4 Score for each muscle

Increasing MQ4



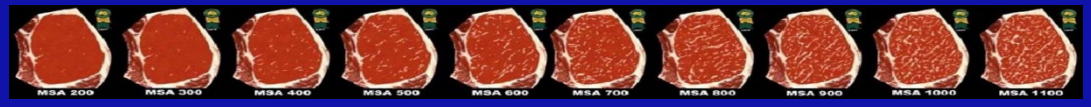
IMF and Flavour

Across Muscle

Increasing Flavour

100
80
60
40
20
0

0 1 2 3 4 5 6 7 8 9 10



IMF

IMF and Flavour

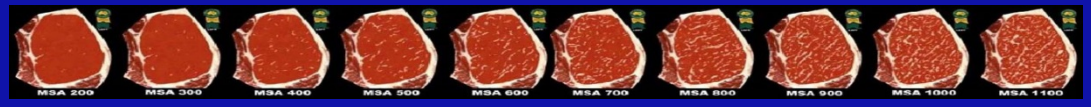
Across Muscle

Increasing Flavour

100
80
60
40
20
0

34.5

0 1 2 3 4 5 6 7 8 9 10



IMF

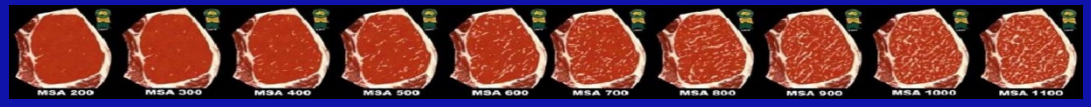
IMF and Flavour

Within Muscle

Increasing Flavour

100
80
60
40
20
0

0 1 2 3 4 5 6 7 8 9 10



IMF

IMF and Flavour

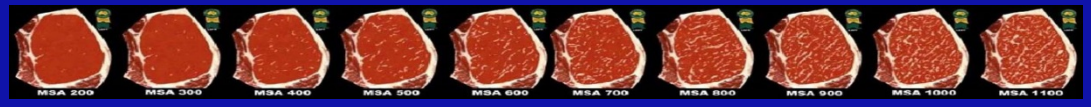
Within Muscle

Increasing Flavour

100
80
60
40
20
0

4.6

0 1 2 3 4 5 6 7 8 9 10



IMF

Magnitude of Impact

Muscle type unknown

	IMF (range: 0.23-9 %)
Tenderness	56.8
Juiciness	39
Flavour	34.5
Overall Liking	44.7
MQ4 Score	43.8

Magnitude of Impact

Muscle type unknown

	Muscle excluded from model		
	IMF (range: 0.23-9 %)	H20 (range: 70-77 %)	Iron (range: 10-25 ug/g)
Tenderness	56.8	28.8	-
Juiciness	39	20.4	12.1
Flavour	34.5	20	9.5
Overall Liking	44.7	23.5	11.5
MQ4 Score	43.8	21.9	10.4

Magnitude of Impact

Muscle type known

	Muscle excluded from model			Muscle included in model		
	IMF (range: 0.23-9 %)	H20 (range: 70-77 %)	Iron (range: 10-25 ug/g)	IMF (range: 0.23-9 %)	H20 (range: 70-77 %)	Iron (range: 10-25 ug/g)
Tenderness	56.8	28.8	-	-	-	-
Juiciness	39	20.4	12.1	-	-	-
Flavour	34.5	20	9.5	4.6	4.0	-
Overall Liking	44.7	23.5	11.5	5.7	4.8	-
MQ4 Score	43.8	21.9	10.4	-	-	-

Conclusion

Hypothesis – muscle unknown

Due to their relationships with IMF

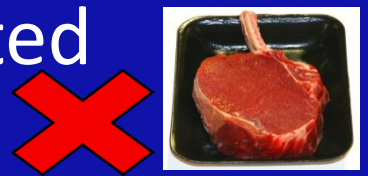
- Iron content will be positively correlated with Flavour scores

- 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

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

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Acknowledgements

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