Plasma lactate at slaughter is associated with loin intramuscular fat in lamb

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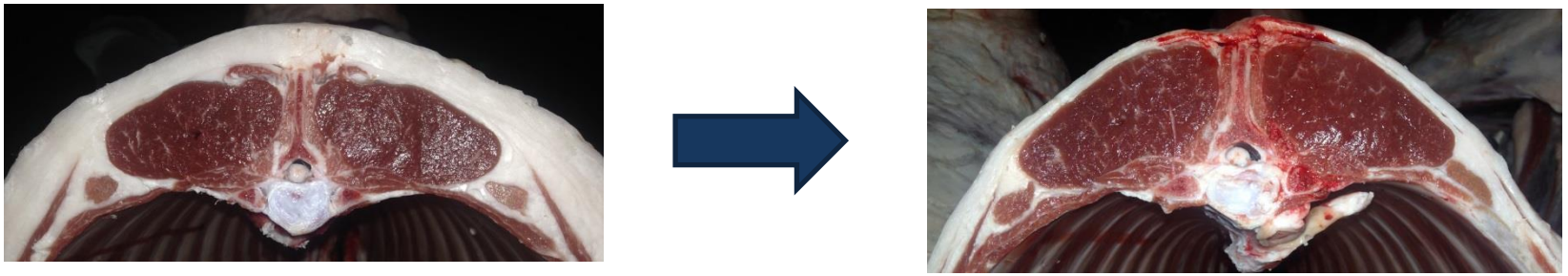
Tuesday - Session 18, September 1st 2015

Outline

- Intramuscular fat (IMF) and lamb eating quality
- Genotype and tissue stress response
- Impact of breeding values on IMF
- Hypotheses
- Association between IMF, plasma lactate and NEFA and muscling
- Future research

Lamb eating quality

- Intramuscular fat (IMF) – a key driver of lamb eating quality
- Ranges from 2-8% in AUS lamb



Selection for leaner, more muscular lambs

Genotype response to stress

ADRENALINE Martin et al 2011

↓ **Muscle response**

↑ **Adipose response**

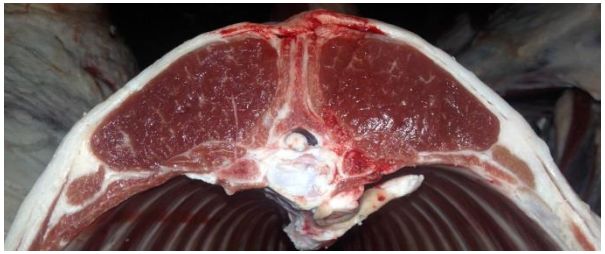
↓ plasma **Lactate**

↑ plasma **non-esterified fatty acids (NEFA)**

Leaner Phenotype

↓ IMF ??

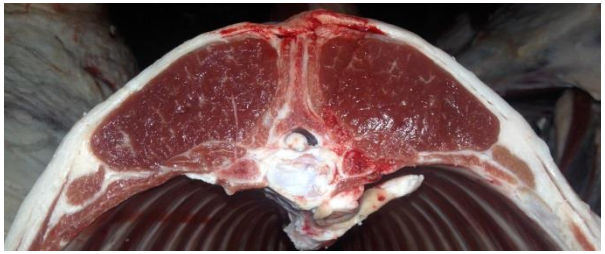
Genotype impact on IMF



Breeding values for muscling

Pannier *et al* 2014

Genotype impact on IMF



Breeding values for muscling

⬇ IMF

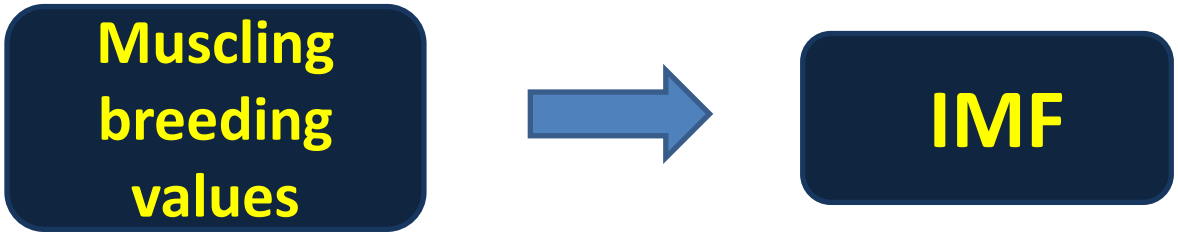
Pannier *et al* 2014

Hypotheses

Assuming ADRENALINE linked….

1. **Positive association between IMF and [lactate]**
2. **Negative association between IMF and [NEFA]**

3. **[NEFA] and [lactate] will account for**



Methods

- Prime Lambs n = 2016
- MLA genetic flocks
  - NSW
  - WA
- ~ 300 sires (AI dams)
  - Breeding values for muscling
- Extensively managed
- 21 - 30 hrs off feed
- Blood collected at slaughter

Plasma [Lactate]

Plasma [NEFA]

% Intramuscular fat

Methods - Analysis

Fixed effects

- Flock
- Drop (year of birth)
- Killgroup effect
- Siretype
- Sex
- Dambreed

Covariates

- Breeding values muscling
- Plasma lactate
- Plasma NEFA

Mixed Linear effect models

% Intramuscular fat

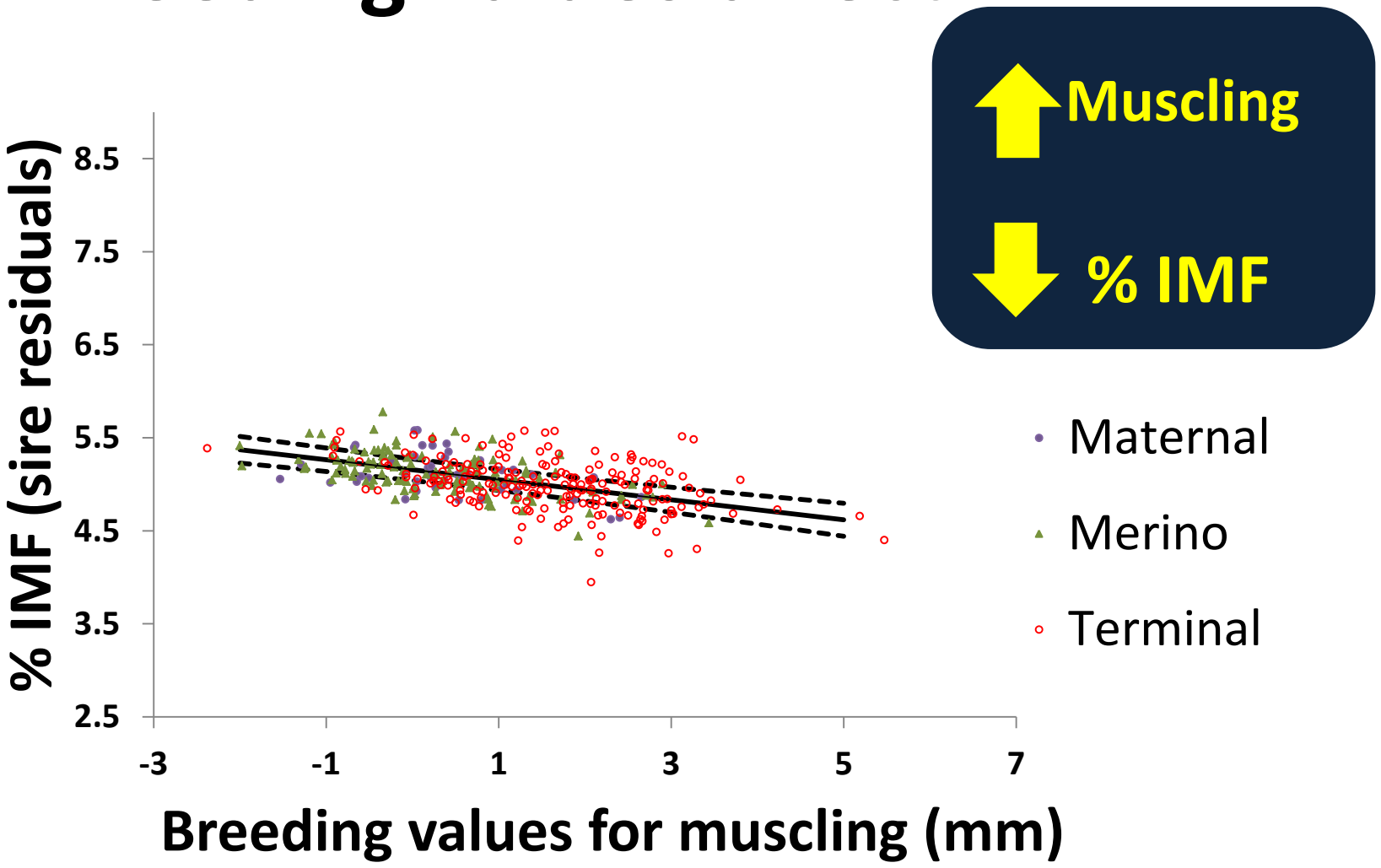
Random terms

Sire ID

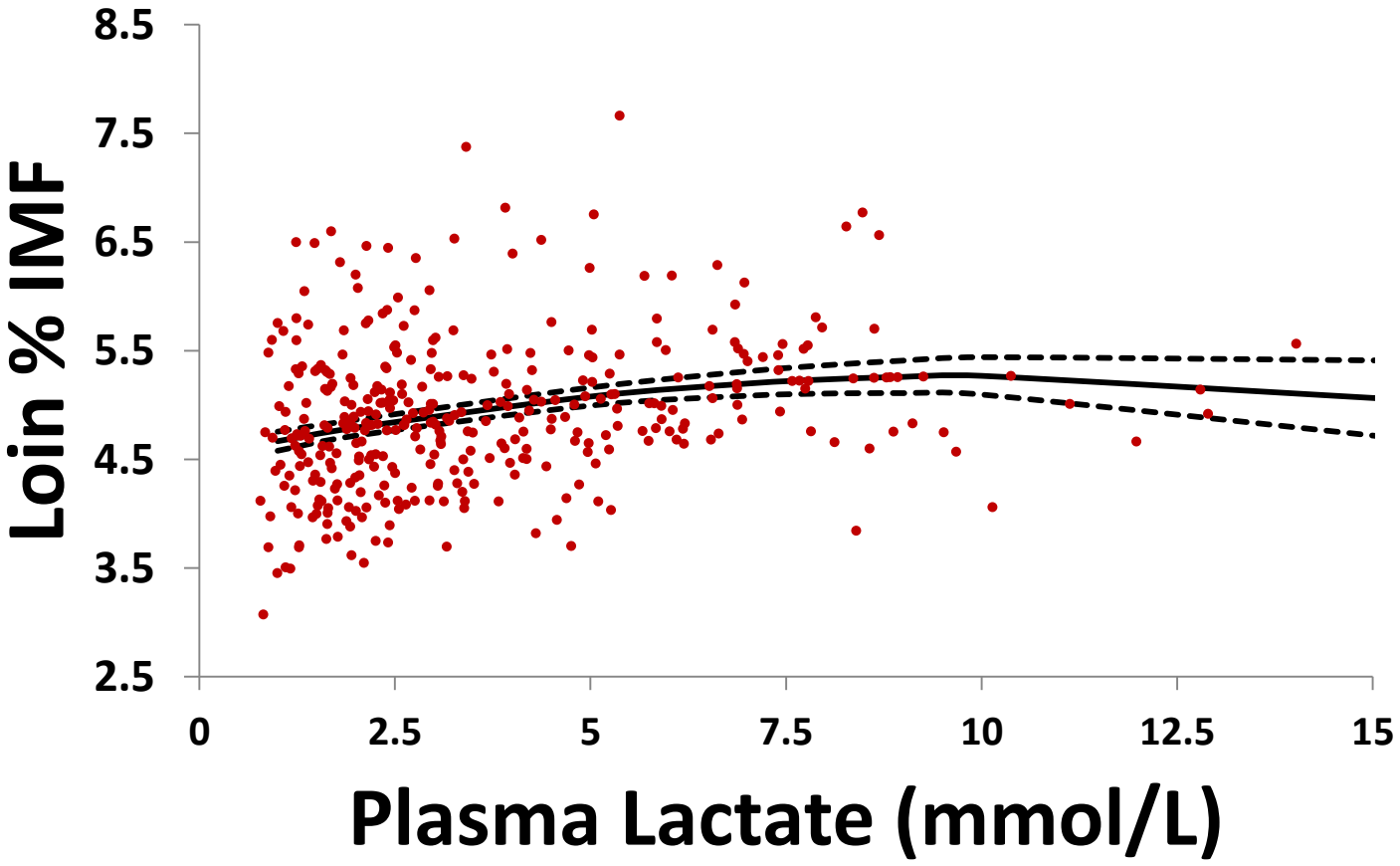
Dam ID*drop

RESULTS

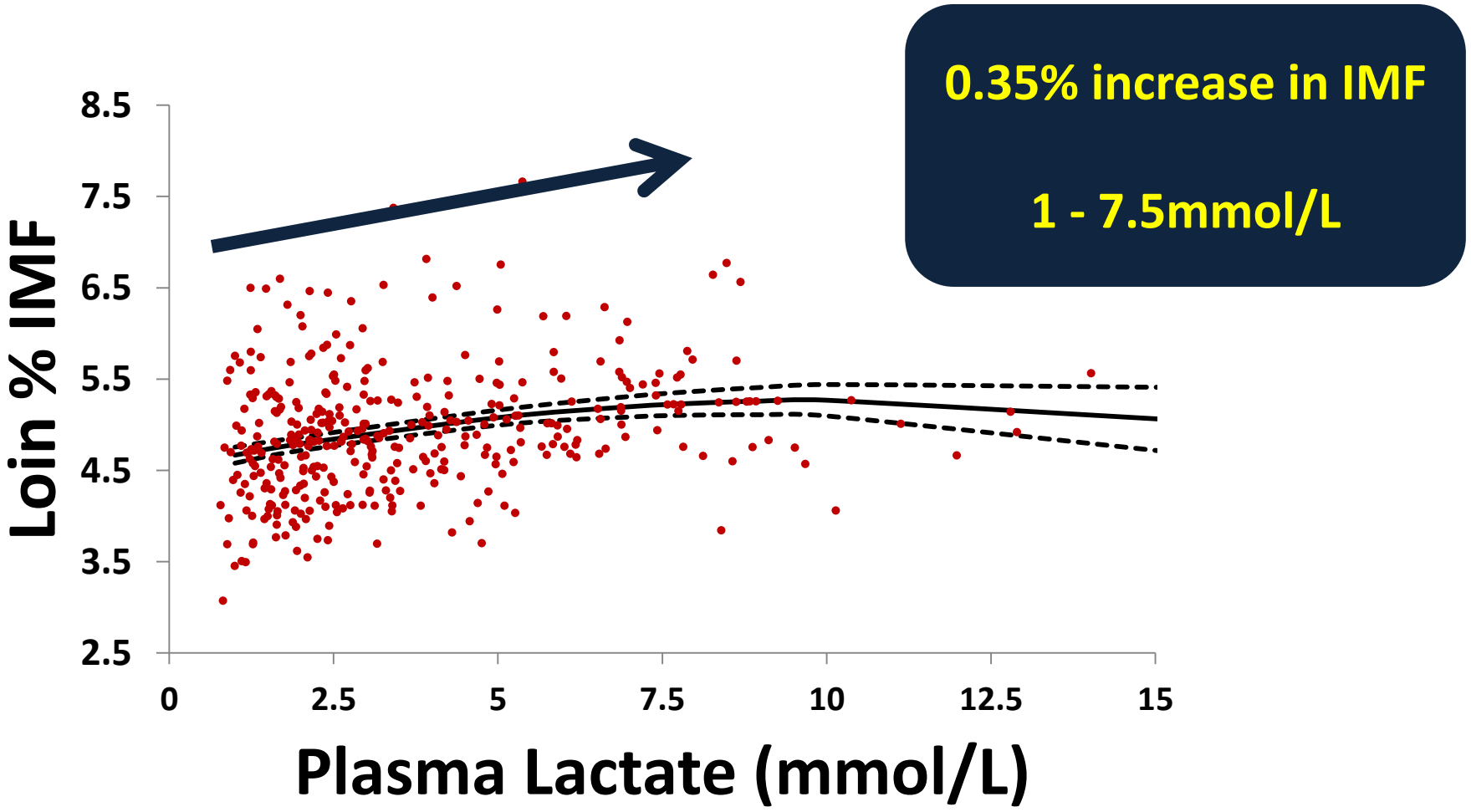
Breeding values affect IMF



Plasma lactate and %IMF



Plasma lactate and %IMF

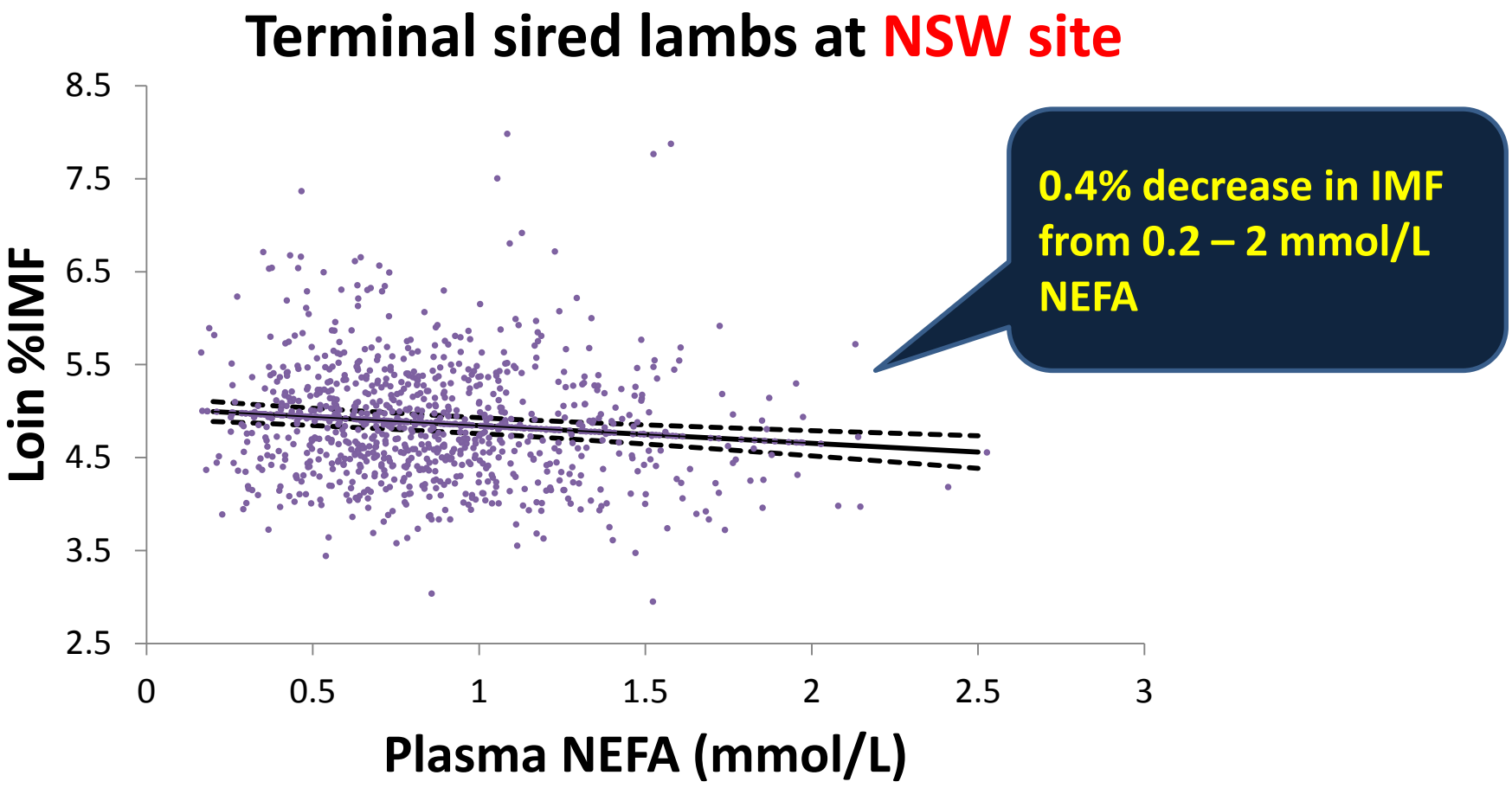


Hypotheses

Assuming ADRENALINE linked….

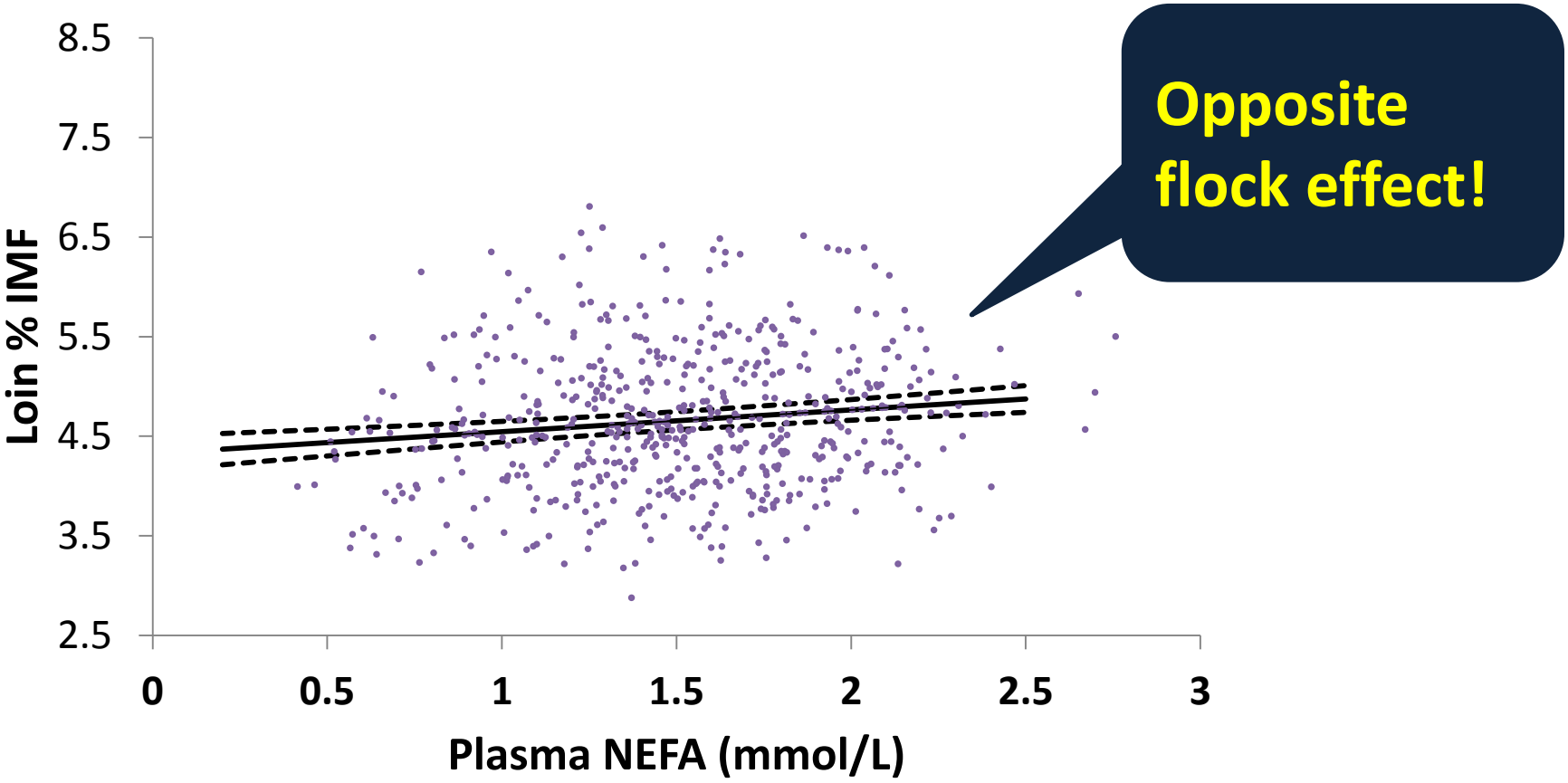
1. **Positive association between IMF and [lactate]**

Plasma NEFA and %IMF



Plasma NEFA and %IMF

Terminal sired lambs at WA site



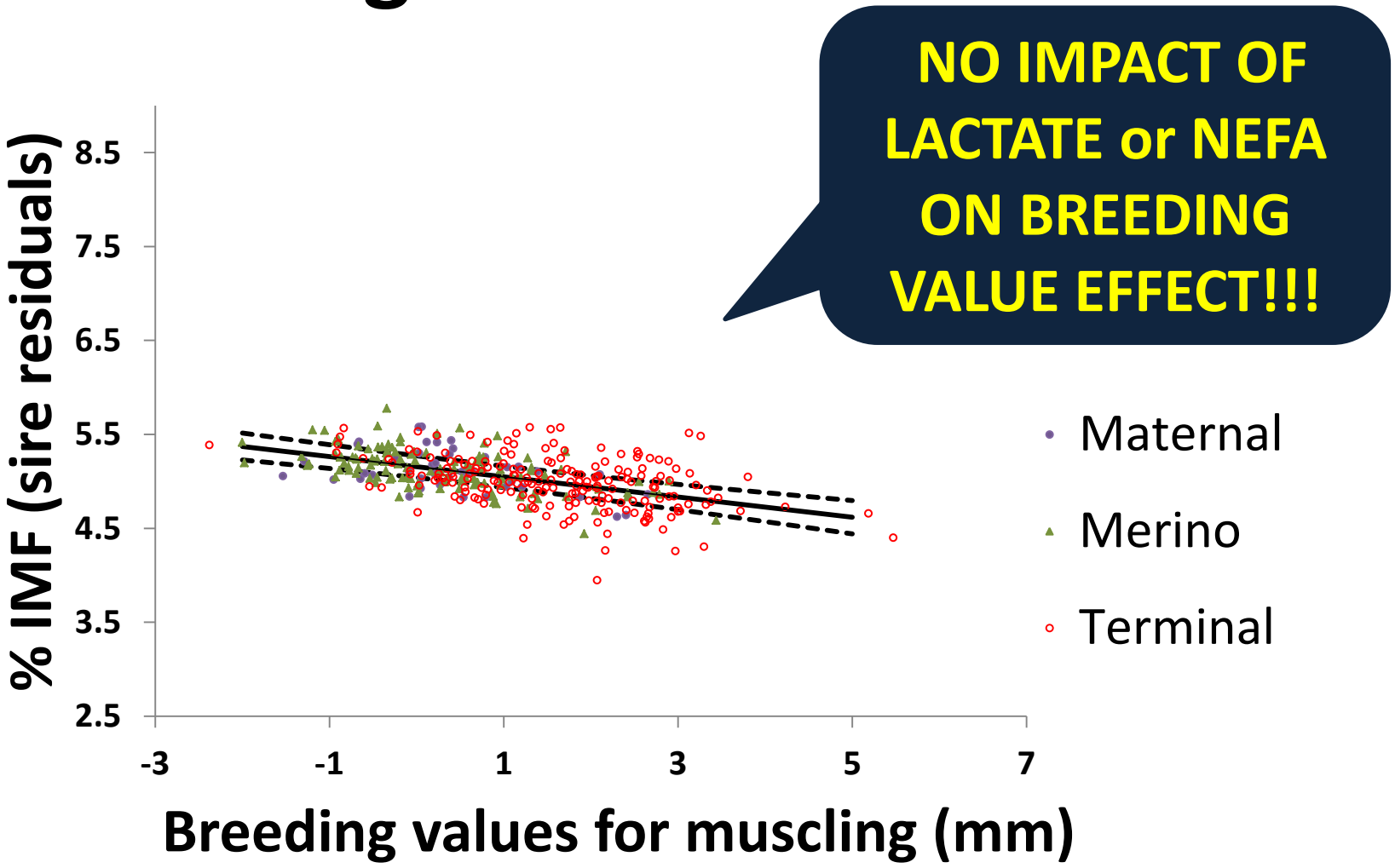
Hypotheses

Assuming ADRENALINE linked….

2. Negative association between IMF and [NEFA]

Are lactate and NEFA describing the breeding value (genetic) effect on IMF?????

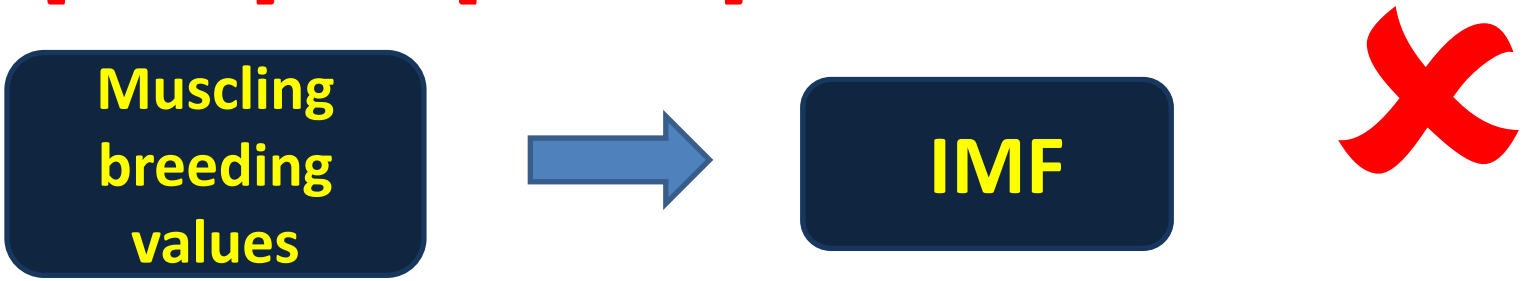
Breeding values affect IMF



Hypotheses

Assuming ADRENALINE linked….

3. [NEFA] and [lactate] will account for



IMF and NEFA association

- Plasma NEFA reflects whole body adipose tissue turn-over
- IMF small component of whole fat depot
- Affected by acute stress and feed deprivation
- Not an accurate/precise indicator of “stress”

IMF and Lactate association

- Lactate indirectly reflecting IMF turn over
- Separate mechanism to breeding value (genetic) effect?
- More accurately reflects stress response in muscle
  - Not impacted by feed deprivation (no glucagon receptors)

Further work

- What influences indicators of stress?
- Relate to carcass and meat quality
  - Shear force, IMF, colour, pHu
  - Sire genetics
  - Consumer sensory panels
- Best practice pre-slaughter management

Contributors

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Graham Gardner
Dave Pethick

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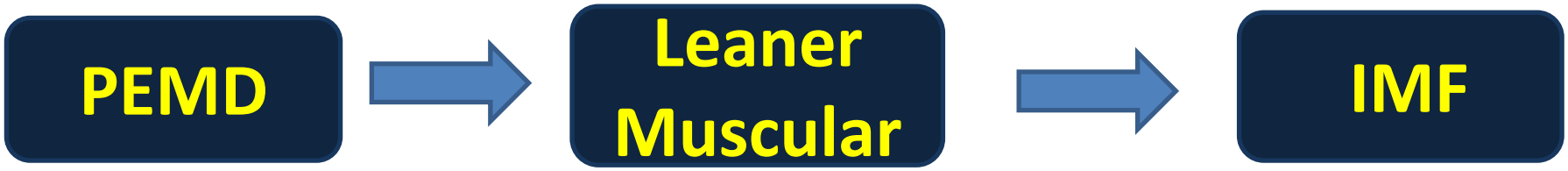
Thank you!

Results

VARIABLE	MEAN ± SD	MIN	MAX
Loin IMF (%)	4.87 ± 1.2	1.7	12.0
PEMD	1.3 ± 1.26	-2.4	5.5
Lactate (mmol/L)	3.48 ± 2.3	0.5	16.4
NEFA (mmol/L)	1.18 ± 0.54	0.17	3.26

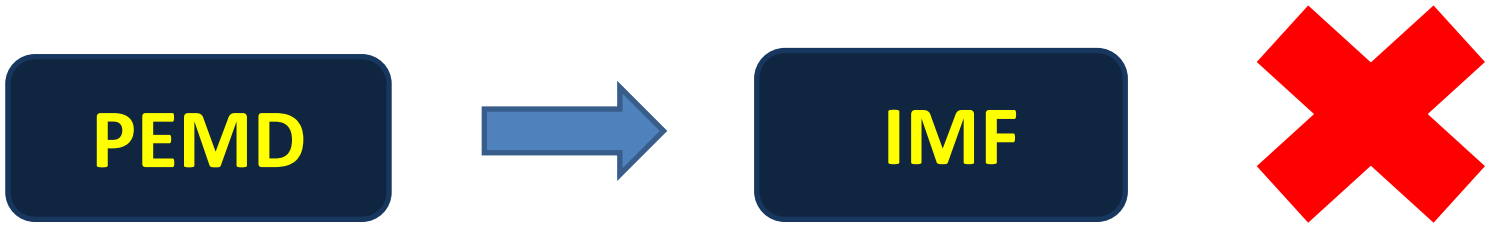
Hypotheses

Assuming ADRENALINE linked….



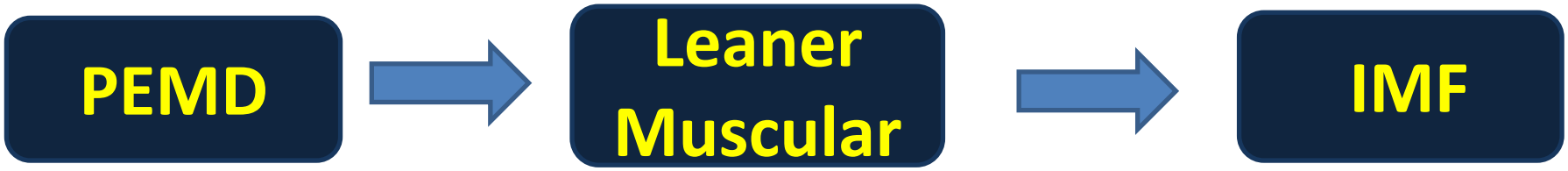
1. Association between IMF
   - Plasma **lactate** (positive)
   - Plasma **NEFA** (negative)

2. **NEFA** and **lactate** will account for

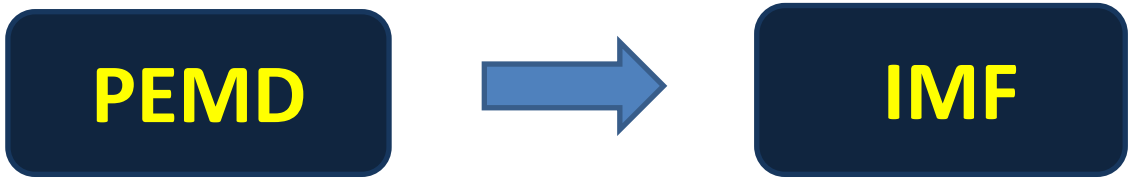


Hypotheses

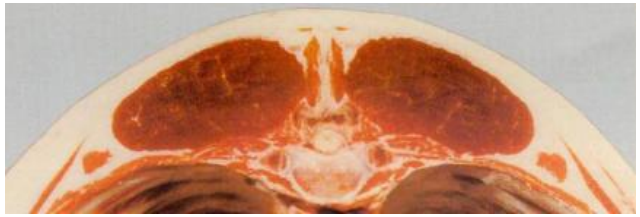
Assuming ADRENALINE linked….



1. **Positive association between IMF and [lactate]** ✓
2. **Negative association between IMF and [NEFA]** ?
3. **[NEFA] and [lactate] will account for** ✗



Response to stress?



ADRENALINE

Martin et al 2011

Muscle

plasma Lactate

Adipose

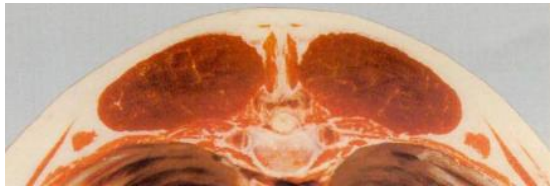
plasma Non-esterified fatty acids (NEFA)

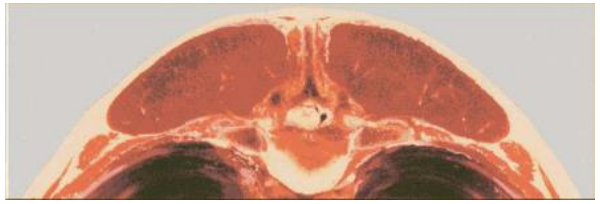
Leaner Phenotype

⬇ %IMF

Impact on IMF

- Intramuscular fat (IMF) – a key driver of lamb eating quality
- Ranges from 2-8% in lamb
- Selection for leaner, more muscular lambs



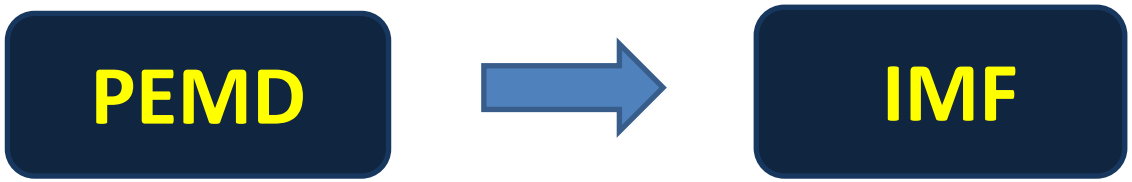


Pannier *et al* 2014

PEMD → ⬇ %IMF

Hypotheses

Assuming ADRENALINE linked….



Hypotheses

1. Association between % IMF *v* **Lactate (+ve)**

Assuming ADRENALINE linked….

PEMD → **%IMF**

Hypotheses

Assuming ADRENALINE linked….

PEMD → **%IMF**

1. **Association between % IMF *v***
   - **Lactate (+ve)**
   - **NEFA (-ve)**

Hypotheses

Assuming ADRENALINE linked….

PEMD → **%IMF**

1. **Association between % IMF *v***

Lactate (+ve)

NEFA (-ve)

2. **NEFA/Lactate will account for**

PEMD → **%IMF**