

*Alternate approaches to
measuring energy expenditure*


Li Li, Nolan, Hegarty

Content

- Using methane production to get at energy expenditure
- Using SF₆ as a tracer for CO₂

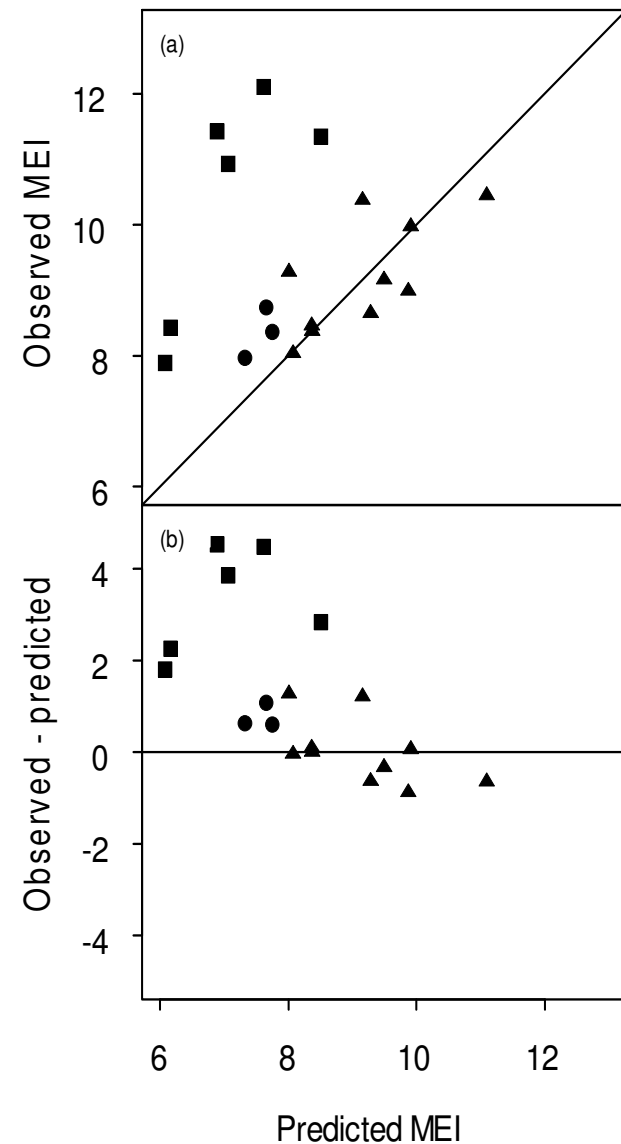
Frustration & a way out ?

- “We need to measure intake” (NFI feeders)
- DMI is only a rough precursor to energy intake
- Energy intake is more use for growth stories
- Metabolisable energy = $0.81 * \text{Digested energy}$

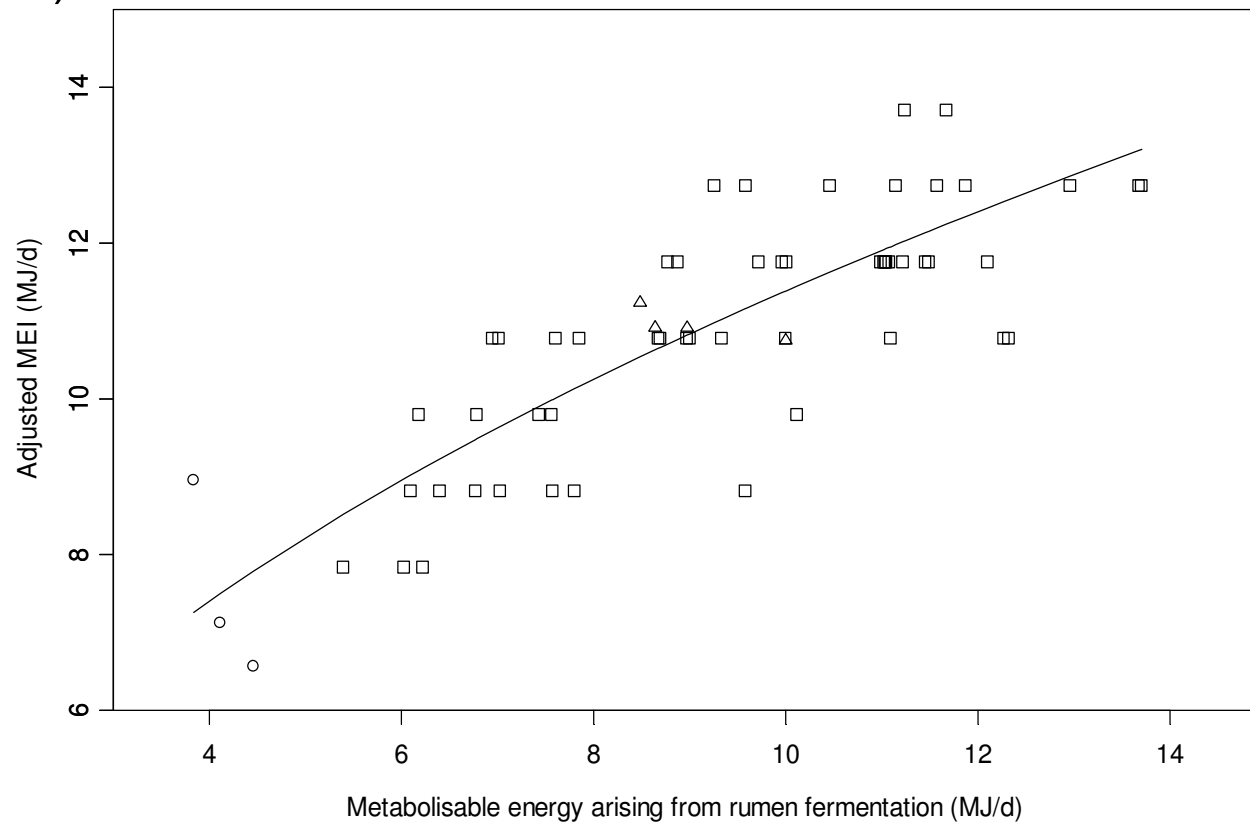


Methane + urinary losses
- If SF₆ allows us to measure methane output, can we use it to back-calculate MEI (ie use the unmetabolisable to predict the metabolisable)?

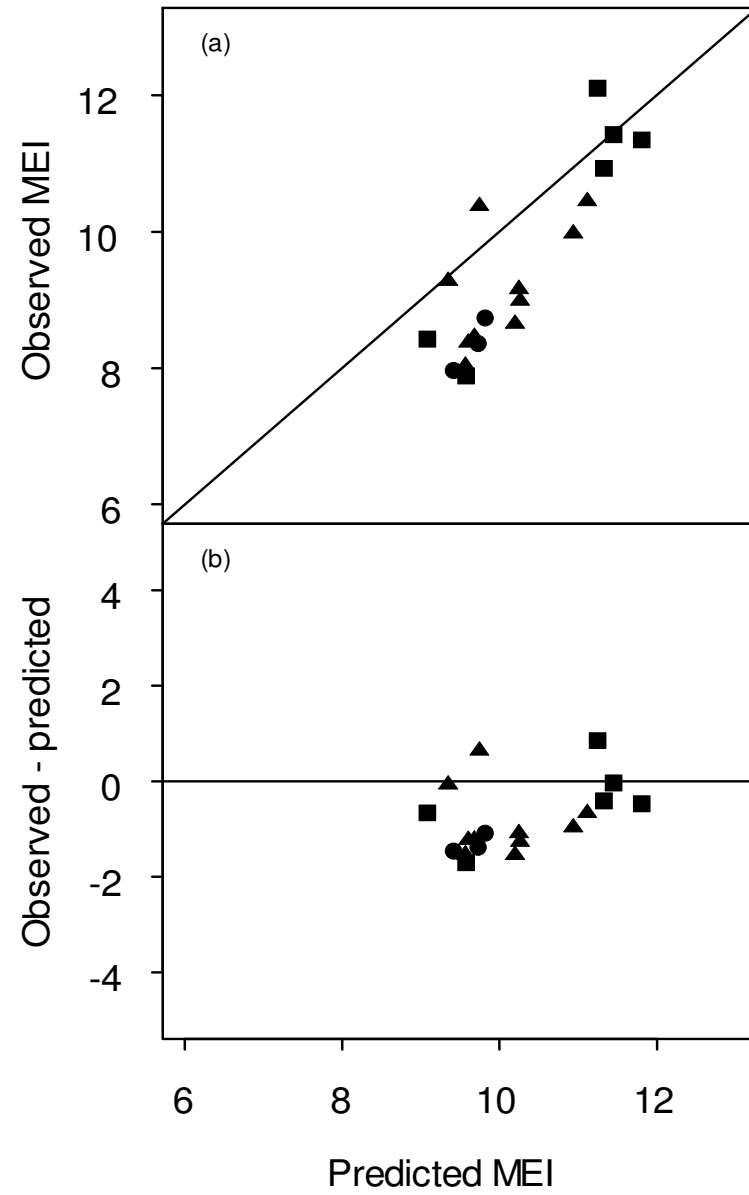
- *Plan* to estimate methane production by SF₆,
- *Plan* to estimate urinary energy loss from rumen [NH₃]
- Using measured values:
- ME intake = (CH₄-E + Urine-E)* (100/0.19)
- SEP = 4.1 MJ



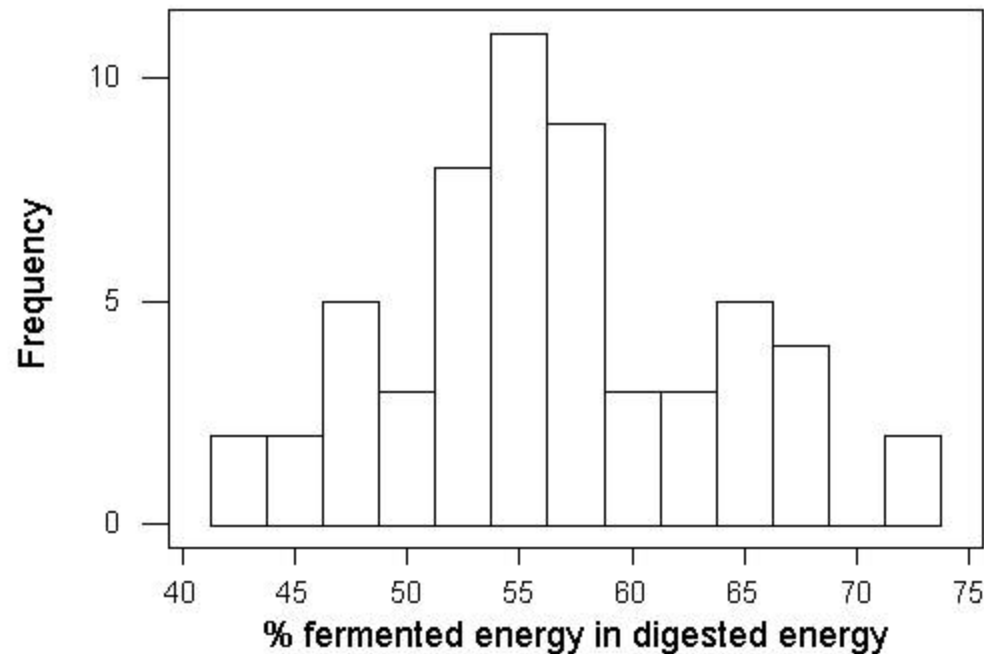
- Estimate methane production by SF₆,
- use a rumen sample to get VFA proportion
- Combine methane prodn & VFA balance to calculate fermented energy (development & calibration sets)



- Tested against independent data set.
- SEP = 1.18MJ
- ~10% of mean



Accuracy of predicting MEI from methane data is limited by varying proportion of digested energy that is fermented



- After Armstrong 1964

New approach

- It's not intake but would it be valuable to estimate energy expenditure from CO₂ production ? (Boadi).

A robust test (MWNZ)

- 2 body weights (to change respiratory CO₂)
- 2 intakes (to change ruminal CO₂)
- Growing lambs (4/cell)
- Energy expenditure by 3 means:
 - Respiration chamber
 - SF₆ tracer (inside & outside chamber [NIWA])
 - D₂O injections (46d apart)
 - E expend = MEI – E stored as judged by composition

Results

- Close agreement in energy expenditure estimated in the respiration chamber (8.2 MJ/d) and D₂O (8.5 MJ/d).
- SF₆-based estimates of CO₂ or CH₄ production made inside and outside the chamber did not differ.
- Using SF₆ over-estimated CO₂ (and CH₄) production by up to 30%, especially on low intake level

Conclusions

- The reason why the SF₆ tracer technique overestimated CO₂ production is unknown
- Why was the over-estimation worse on low intake levels (other SF₆/methane studies?)
- Our capacity to estimate energy expenditure by SF₆ tracer is stalled; but D₂O was beautifully simple and data rich way of getting long term E expenditure.