

Energy partitioning in lactating Holstein-Friesian cows with divergent residual feed intake

LC Marett, SRO Williams, BJ Hayes, JE Pryce, WJ Wales

Introduction

- Efficient use of feed for milk production is essential for profitable dairy farming
- Residual Feed Intake (**RFI**): The difference between an animal's actual intake and that theoretically expected for maintenance, growth and production

High RFI = **Inefficient**

Low RFI = **Efficient**



Introduction

- RFI is heritable

Williams et al. (2011)



- Divergence in RFI from growing calves to lactating cows is decreased

Macdonald et al. (2014)

- Calves (during growth) ~21%
 - Cows (during lactation) ~3%
- More pathways for partitioning of dietary nutrients as cows mature
 - maintenance, growth → maintenance, growth, lactation, pregnancy

Hypothesis

- That energy partitioning will not be different when comparing efficient and inefficient animals (based on RFI as calves).



Methods

- Exp. 1:
 - 16 **Heifers** (1st lactation)
 - 8 Low RFI, 8 High RFI
- Exp. 2:
 - 16 **Cows** (2nd or 3rd lactation)
 - 8 Low RFI, 8 High RFI
- Total energy balance measurements
 - 4 days metabolism stalls
 - 3 days respiration chambers
 - Total daily collections of feed, milk, faeces, urine, (methane, O₂, CO₂)



Results

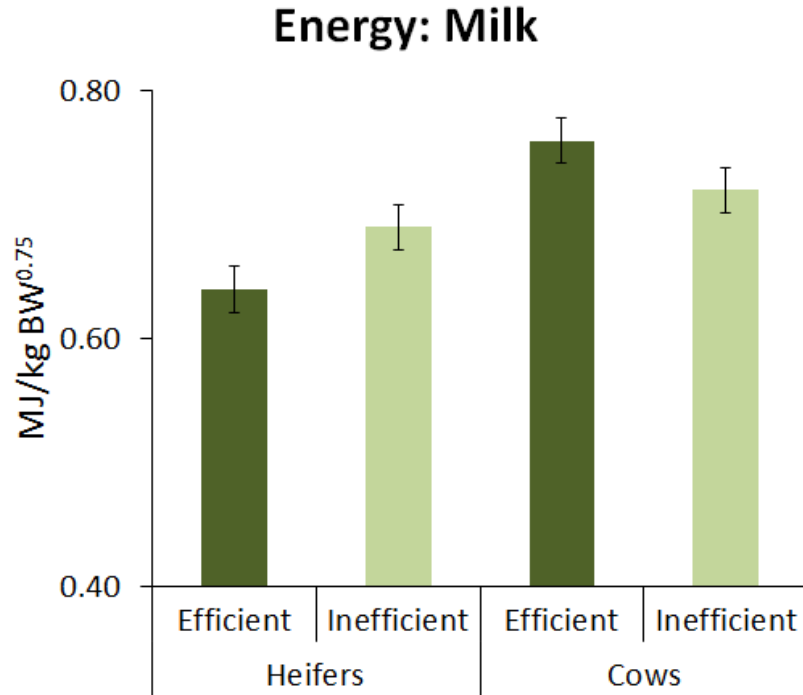
- Cows had greater DMI, and milk, faeces, urine, heat and methane output than heifers ($P < 0.01$).
- Cows had lower total tract digestibility than heifers ($P < 0.001$)
- No difference in proportion of energy partitioned to milk, but cows partitioned a greater % of gross energy intake to faeces and urine, and a lower % to methane and heat compared with heifers ($P < 0.05$).
 - Interactions between parity and RFI present
- No overall effect of RFI
 - Interactions between parity and RFI present

Results

Parity $P = 0.013$

RFI = NS

Int. $P = 0.088$



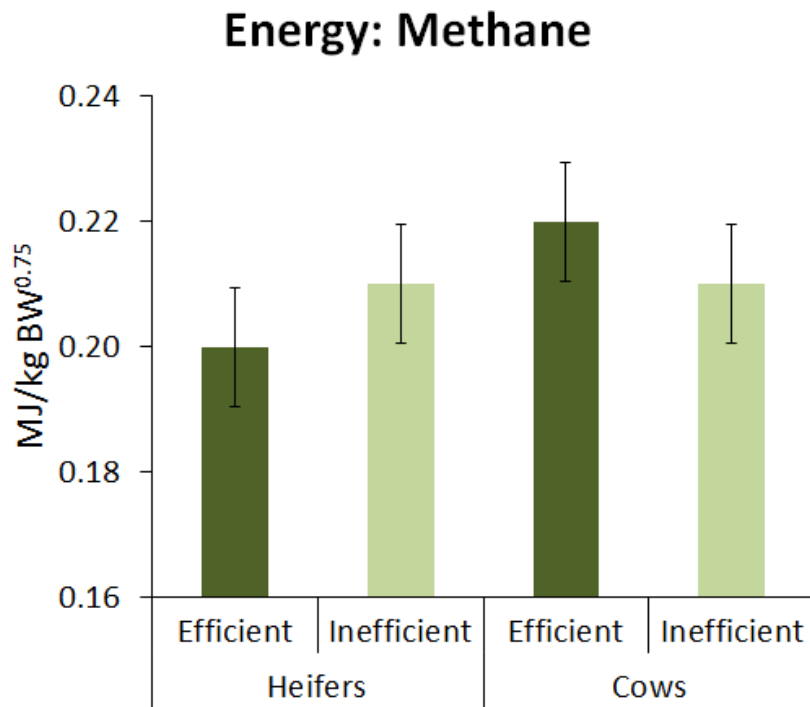
- Cows partitioned more energy to milk per kg BW^{0.75}

Results

Parity = NS

RFI = NS

Int. = NS



- No difference in methane production per kg BW^{0.75}

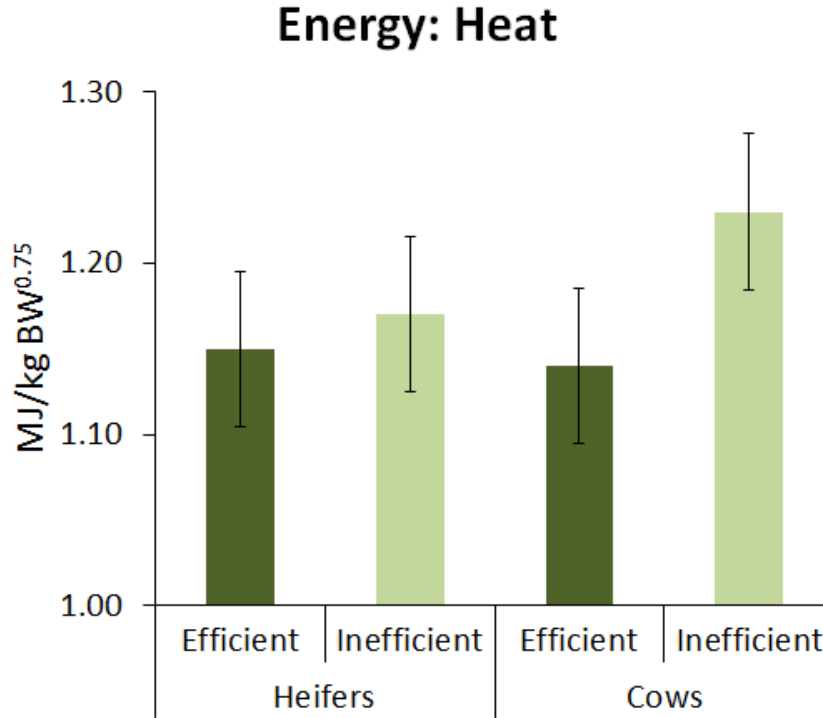


Results

Parity $P = 0.042$

RFI = NS

Int. $P = 0.016$



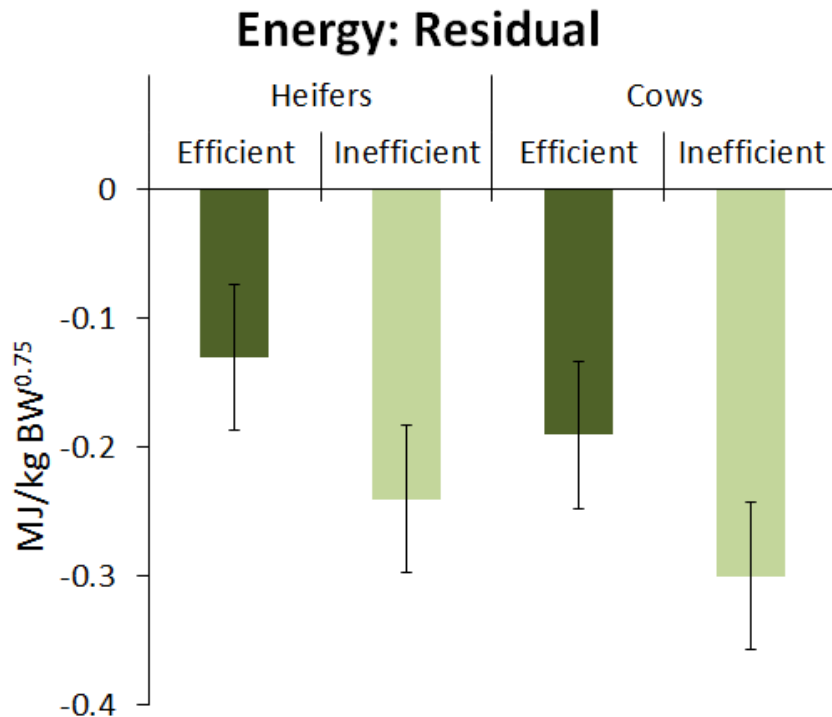
- Cows partitioned more energy to heat production per kg BW^{0.75}
- Inefficient cows consistently wasted more energy as heat

Results

Parity = NS

RFI = NS

Int. = NS



- No overall effect of RFI
- But, Inefficient group have consistently lower residual (more energy from body stores)?

Conclusions

- No overall effect of RFI
 - Preliminary evidence that inefficient cows waste more energy in heat production than efficient cows

- Potential for difference in energy partitioning in Holstein-Friesian cows selected based on RFI as calves
 - This may change with slowing or cessation of growth
 - Selection for improved efficiency may lead to a greater proportion of energy being partitioned to milk and less to heat as cows mature

