Animal health and GHG gas intensity: the paradox of periparturient parasitism

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Background

• Pathogen exposure reduces feed intake
  - Parasitism would reduce GHG output
  - Does parasitism affect GHG yield?

• Pathogen exposure reduces performance
  - Parasitism may increase nutrient input to obtain similar production output

• Here, we assessed the impact of ewe parasitism on GHG intensity for lamb production
Materials and Methods

- **Experimental treatments (n=16)**
  - Control
    - sham infection (water)
    - ad libitum fed pelleted lucerne throughout
  - Parasitised
    - Teladorsagia circumcincta (abomasal nematode)
    - trickle infection (10,000 L₃, Mon-Wed-Fri)
    - ad libitum fed pelleted lucerne throughout
  - Restricted
    - sham infection (water)
    - fed pelleted lucerne at 80% of control during lactation
Materials and Methods

• Periparturient observations (n=16)
  - From d_{-28} to d_{30} (d_0 is lambing)
  - Weekly body weight
  - Twice weekly feed refusals
  - Total tract digestibility (d_{28} to d_{30})

• Respiration chambers (n=8)
  - From d_{30} to d_{36}
    • 3 days adaptation
    • 3 days measurements
      (last day used in calculations)
Materials and Methods

- Respiration chambers
  - Enteric GHG production
    - Methane
    - Carbon dioxide

- Total tract nutrient digestibility
  - Organic matter (dOMI)
    - Volatile solids
    - Manure methane
  - Nitrogen
    - N excretion
    - Manure nitrous oxide
Ewe performance during lactation

• Parasitism reduced performance
  1. Anorexia
  2. Reduced litter weight gain
  3. Increased body weight loss
Enteric Methane

- Parasitism and enteric CH$_4$
  1. Reduced production
  2. No effect on yield per kg DMI
  3. Increased yield per kg dOMI
Enteric Carbon dioxide

• Parasitism and enteric CO₂
  1. Reduced production (trend)
  2. No effect on yield per kg DMI
  3. Increased yield per kg dDMI
Manure Methane

- Parasitism and manure CH$_4$
  1. No effect on production
  2. Increased yield per kg DMI
  3. Increased yield per kg dOMI
Manure Nitrous oxide

- Parasitism and manure N$_2$O
  1. No effect on production
  2. Increased yield per kg DMI
  3. Increased yield per kg dOMI
GHG combined

- Parasitism increases combined GHG yield per kg dOMI
Feed need to wean lambs at 25 kg

- Parasitism and feed need to target
  1. Similar to weaning
  2. Greater to restore BW
  3. Total feed need drives GHG intensity for lamb production
Feed conversion ratio and GWP

• Ewe parasitism
  1. Increased FCR
  2. Increased GWP/kg lamb weight gain
Discussion

• Parasitism reduces productivity
  - ewes will require longer feeding to reach similar weaning lamb body weight and compensate for higher rate of maternal weight loss
  - this increased feed requirement will increase total GHG output during production cycle

• Parasitism reduces feed value
  - ewes will require longer feeding and rely on body reserves to reach similar dOM intake (proxy for metabolizable energy intake)
  - increased GHG from extra feed requirements: ~16%
  - increased GHG yield per kg dOMI: ~22%
Conclusion

• Periparturient parasitism increases methane intensity for lamb production
  - Increased feed conversion ratio
  - Anorexia
  - Reduction in nutritional value

• Animal health impacts on GHG intensity
  - Quantify impacts through feed conversion ratio
  - Consider additional direct effects
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