



Centre for  
Tropical Livestock  
Genetics and Health

# You can't have it all – unless you feed appropriately

Ibrahim Akinci\*, Olivier Hanotte\*,† and  
Nick Sparks‡

University of Nottingham\*, ILRI†, SRUC‡





# Background

- Highly productive birds perform well if fed and protected, but underperform in semi-scavenging systems – this matters
- Evidence that indigenous birds are more resistant/resilient to endemic disease (and less prone to predation)
- Mechanism?
  - a more appropriate immune responses; adequate nutrition for an equally efficacious immune response or a combination of the two – if the last, where does the balance sit?
- Lots of anecdotal health information, far less biologically or system relevant information – new tools will help address this







## Why may nutrients be limited?

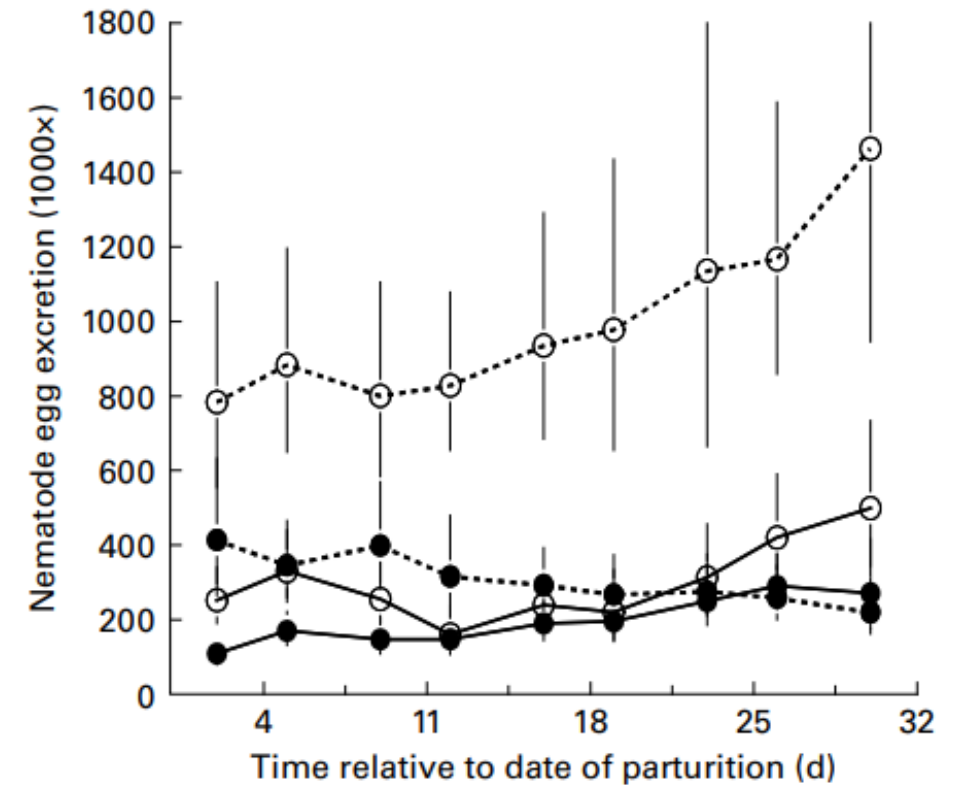
- Sources of feed to be scavenged will change with season
- Quantitative *and* qualitative restrictions
- Larger poultry less effective scavengers
- Supplementary feeding may be fixed
- **Birds that produce more require more feed - ‘mature’ broiler, layer, dual purpose, indigenous bird eat 220g, 110g, 210g, <100g respectively**
- Is it easier for indigenous birds to meet their nutrient requirement in the field and/or are nutrients partitioned more equally?

## What evidence is there for nutrients being partitioned





- Ruminant and monogastric mammals - disease challenge in pregnancy
- In poultry cage layer fatigue
- Many breeding and research programmes use *ad libitum* feeding programmes
  - Fast growing broilers and high producing layers, in the absence of antibiotics, achieve <5% livability across the World.
  - Has selection for productivity driven partition in favour of productivity at expense of health *when nutrients are limiting?*



**Fig. 4.** Daily nematode egg excretion (eggs/d with 95% CI) of twin-rearing Blackface (BF) and Mule (MU) ewes, trickle infected with *Teladorsagia circumcincta* and fed at either 0.8 (low protein, LP) or 1.3 (high protein, HP) times their assumed metabolisable protein requirement during late pregnancy and lactation. --○--, LP-MU; -○-, HP-MU; --●--, LP-BF; -●-, HP-BF.

Kidane et al. (2010)



Centre for  
Tropical Livestock  
Genetics and Health

# Hypotheses

**when nutrients are limited immune response will be restricted in animals selected for productivity and**

**the greater the selection pressure for ‘product’ the greater the compromise**



# Approach

- Proof-of principal studies in UK and Ethiopia
- Birds subject to varying degrees of partition pressure (ie nutrients to product)
  - Most extreme – broiler and sexual mature laying hen
  - Least extreme – sexual immature laying hen (proxy for indigenous bird)
  - Intermediate – dual-purpose bird
- Feed constraint
  - Quantitative reduction of 10% of breed recommendation  
How best to replicate scavenging environment reproducibly in pen study?  
Quantitative, qualitative, mix of the two?







Centre for  
Tropical Livestock  
Genetics and Health

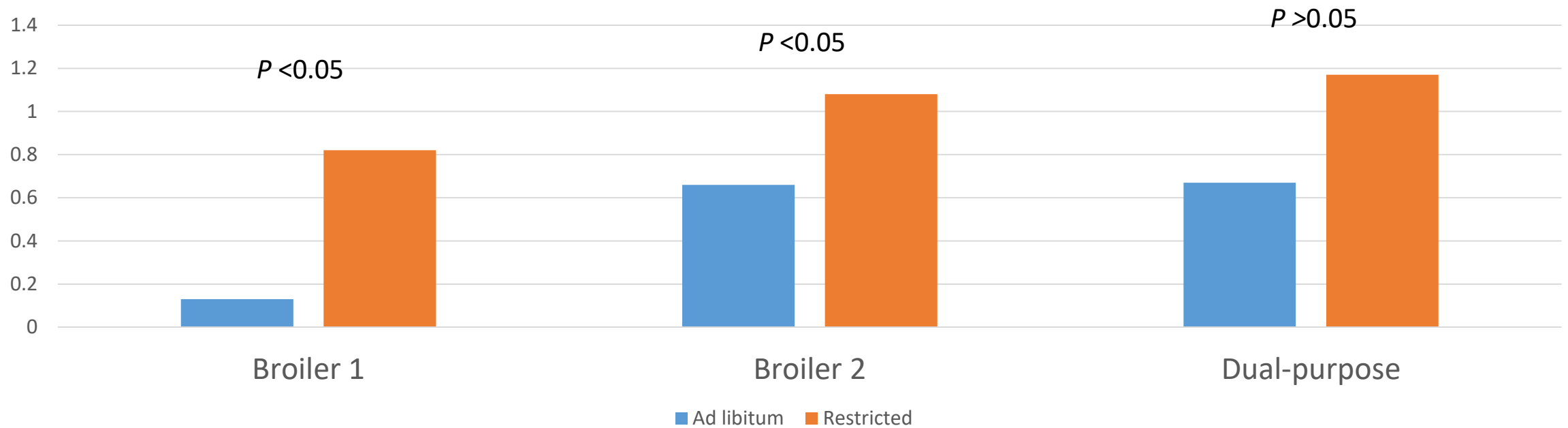
- Sub-clinical Disease challenge
  - *Eimeria tenella* – lesions scored 0 – 4 (no, mild, moderate, severe, v severe)
  - Relevant and reproducible (experimental and welfare)
  - Gavaged at 21 days of age
- Replicated pen studies - typically 96 birds/type and four birds/pen and 6 replicates





# Initial findings

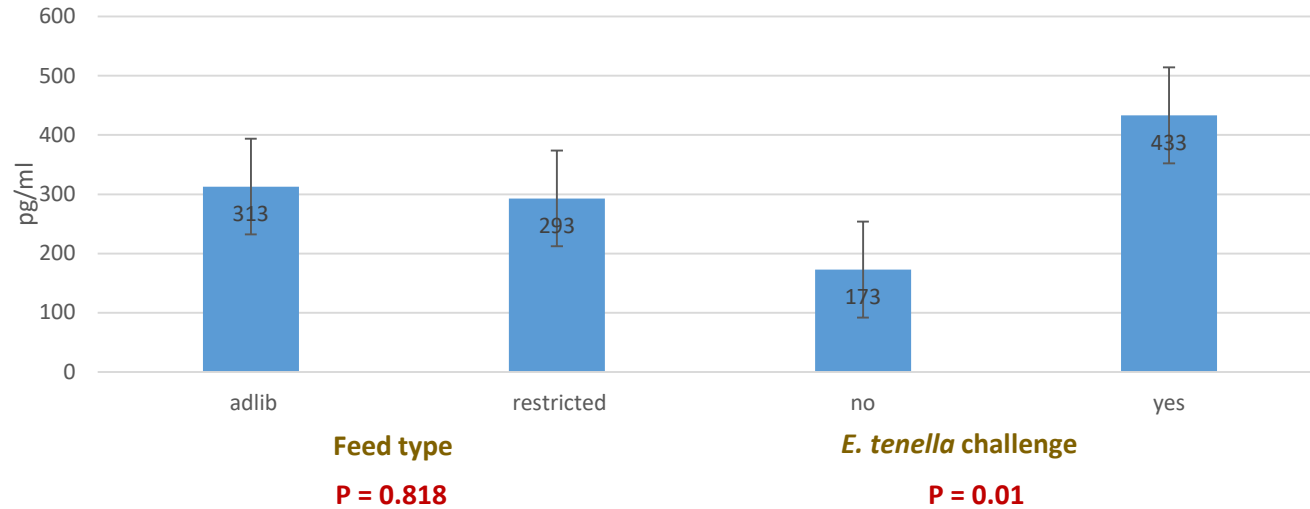
*Eimeria* lesion score at day 29, 8 days PI





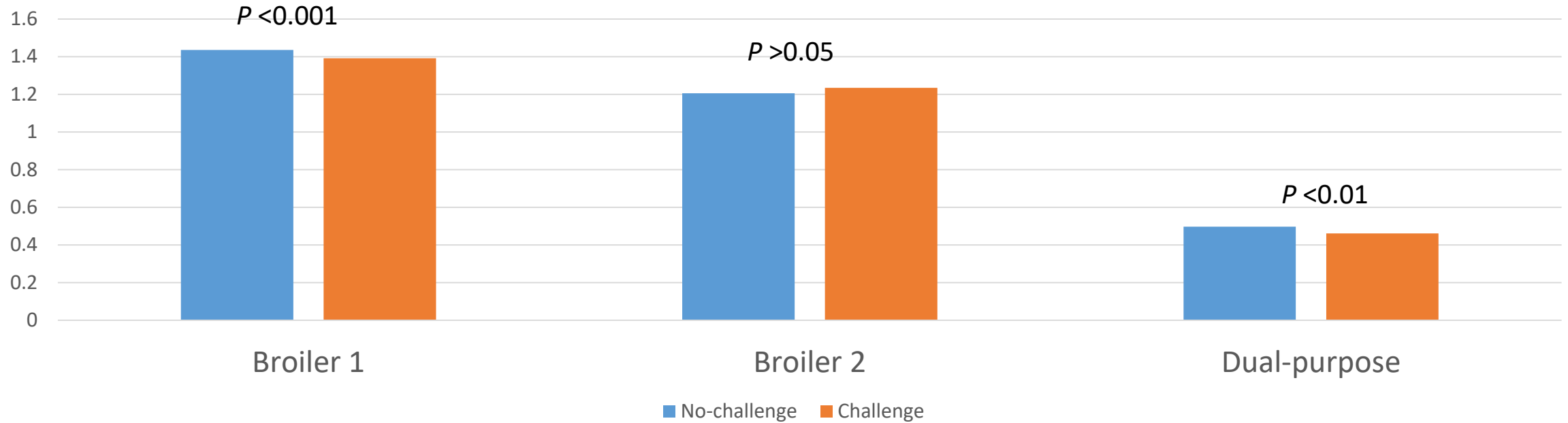


## Interleukin 10 (anti-inflammatory cytokine) (pg/ml)





## Body weight (kg) at day 29, 8 days PI





# Conclusions

## Challenge models

- Quantitative feed achieved modest weight loss and no treatment mortality – acceptable proxy for semi-scavenging systems
- Gavaging *Eimeria* oocyst achieved reproducible sub-clinical infection and no treatment mortality – acceptable model for enteric disease but consider using *E. acervulina*

## Outcomes - sub-optimal nutrition

- Significantly increased likelihood of enteric damage from *Eimeria* in broilers
- Numerical increased enteric damage in dual-purpose birds
- Reduced body weight gain (and, from other studies, egg mass)





## Outcomes – immune response

- Clear IL 10 response in challenged vs unchallenged birds, overlaying nutritional treatments gave inconclusive results – indicative of other mechanisms or confounders?

Initial findings support the hypotheses – nutrient scarcity and selection for growth were associated with poorer health outcomes.

Mechanisms to be elucidated but consistent with studies in other species.

This pilot study established procedures and baselines – extending now to pullets, adult dual purpose and indigenous birds – those most relevant to semi-scavenging systems.

**Most breeding programmes assume optimum nutrition to drive productivity**

**Suboptimal nutrition does not only mean slower growth rates or less egg mass – there may be a health trade-off**



Centre for  
Tropical Livestock  
Genetics and Health

# Acknowledgements

## Ethiopia (Addis Ababa)

Mekonnen Girma and staff at  
the ILRI poultry facility

## UK

Damer Blake (RVC)

Farina Khattak and staff at the  
SRUC Allermuir poultry facility



Centre for  
Tropical Livestock  
Genetics and Health

# CTLGH Funders

BILL & MELINDA  
GATES *foundation*







Centre for  
Tropical Livestock  
Genetics and Health

**Thank you**

[www.ctlgh.org](http://www.ctlgh.org)

