Salivary IgA: a biomarker for *Teladorsagia circumcincta* infection in sheep

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ABSTRACT

Teladorsagia circumcincta is the dominant nematode of sheep in cool, temperate climates. Faecal nematode egg counts (FEC) are widely used to identify the intensity of infection. However due to density-dependent effects on worm fecundity the relationship between FEC and worm burden is not linear and there is a need for more reliable markers of infection. There are two major mechanisms of immunity to *T. circumcincta*; IgE against third stage larvae (L3) which inhibits larval establishment and IgA against fourth stage larvae (L4), which inhibits parasite growth. We measured salivary IgA responses against L3 antigen by Enzyme Linked Immunosorbent Assay (ELISA). IgA levels were negatively correlated with FEC and were highly heritable indicating that they are a useful biomarker of infection. Ecological theory predicts that a trade-off between immunity and host-growth will exist due to competing energetic needs. IgA responses were positively correlated with muscle deposition such that the expected trade-off between growth and immunity was not apparent. However, the trade-off between growth and immunity was evident when IgE responses were investigated, suggesting that the mechanisms governing such trade-offs are more complicated than resource allocation alone and that the type of immune response is important.

INTRODUCTION

The relationship between FEC and worm number is not simple (Fig.1). So as a measure of resistance to nematodes FEC are unreliable.

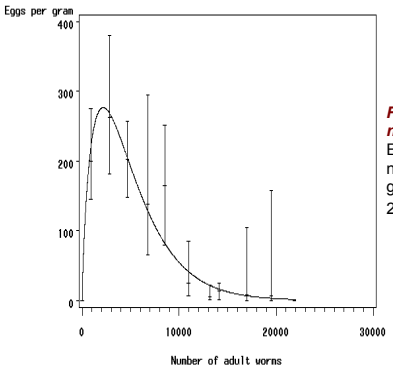


Fig 1: Parasitology of sheep at necropsy.
Egg counts (y-axis) against worm number (x axis). Individuals (n=531) grouped by worm number (e.g.0-2000, 2001-4000, 40001-6000…)

Host immune-responses directly affect infection intensity e.g. abomasal IgA responses are associated with reduced worm length and fecundity. However sampling the site of infection can only be done at necropsy. Saliva can be readily collected in large amounts (Fig. 2) and contains IgA that can be measured by ELISA.


Fig 2: Sampling oral cavity

AIM

To assess the potential for salivary IgA antibody to be used as a marker of resistance to *T.circumcincta* infection.

APPROACH

Using an homogenate of L3 as ELISA antigen, we measured salivary IgA from 2600 Lleyn sheep naturally infected with *T. circumcincta*. The anti-L3 response is strongly correlated to the anti-L4 response and L3 are obtained without sacrificing the host. Optical density (OD) values from the ELISA expressed as an OD index [(sample-control)/(high standard-control)] were compared to FEC and muscle deposition.

RESULTS

Analysis of IgA response with respect to FEC reveals that animals with higher IgA have reduced infection with *T. circumcincta* (LogFEC Rg =-0.56±0.15) and *Nematodirus* species (LogNemFEC Rp = -0.12).

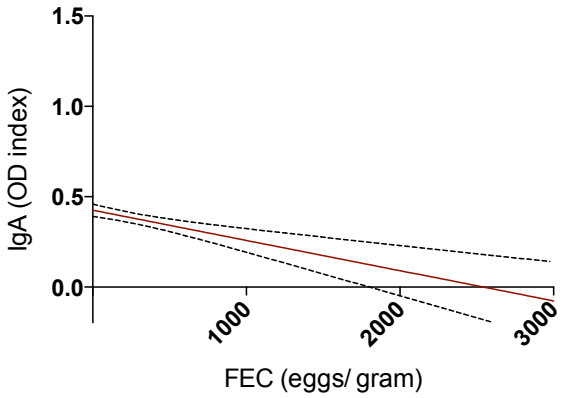
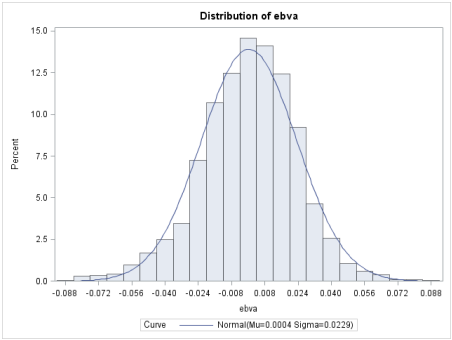


Fig 3: Negative correlation between IgA and FEC
Representative data plotted from one farm (n=366)

IgA responses were also associated with increased growth (muscle depth Rp =+0.15). Suggesting that there was no 'cost' to mounting this immmune response.

To allow comparison of individuals across different farms known pedigrees and the heritability of IgA response (0.35 ± 0.07) were used to determine the Estimated Breeding Values for IgA (Fig. 4).

Fig 4: Estimated Breeding Values for IgA



CONCLUSIONS

- Salivary IgA is superior to FEC as a marker of resistance to *T.circumcincta*.
- IgA responses are positively associated with growth

IMPLICATIONS & FUTURE DIRECTIONS

Identify and clone L4 antigens recognised by IgA to improve ELISA.

The IgA response to *T. circumcincta* also targeted *Nematodirus*. Mounting cross-reactive responses can benefit a host exposed to antigenically-related parasites.

Investment in IgA response did not seem to incur a cost to the host. By understanding costs and benefits of antigen-specific responses can we further optimise vaccine design?

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