Characterization of blood immunoglobulin responses to *Haemonchus contortus* in resistant and sensible creole kids naturally infected with gastrointestinal strongyles

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> Control of gastrointestinal nematode: a challenge for the sustainability of small ruminant production in humid tropics

> Creole goats: - resistance to strongyles is genetically controlled

- genetically original ressource possessing favorable allele for adaptation

➢ Good model for the characterisation of mechanisms and gene of resistance
Material and methods

Herd management

> INRA Experimental farm – Guadeloupe (FWI)

> Flock grazed on pasture and naturally infected with *H. contortus*, *T. colubriformis* and *O. columbianum*

> After weaning: drenching every 8 weeks

> Faecal samples collected at 7 and 11 month of age for genetic evaluation since 1995
Material and methods

> 2 extreme groups of 5 animals (7 months of age)
> Average breeding values on faecal egg counts (FEC) distant of 0.88 genetic standard deviation
> FEC at 7 months 4 times lower in resistant kids compared to sensibles kids

➢ Parasitological and immunological parameters measured on the 2 extreme groups 7 and 8 weeks after drenching
Data collected

> Necropsy and worm counts occurred on week 8

> FEC, PCV and eosinophil concentration estimated at week 7 and 8

> Immunoglobulin (Ig) G, A, E humoral responses against *H. contortus* estimated by ELISA at week 7 and 8
Material and methods

Statistical analyses

> Effect of kids resistance status tested by the non parametric Kruskal-Wallis test

> Correlations between parameters estimated with Spearman rank coefficients
## Results

### Characterization of kids in resistant or sensible

<table>
<thead>
<tr>
<th>Kid status</th>
<th>LFEC Breeding Value (log(epg+15))</th>
<th>Phenotypes Week 7 of reinfection</th>
<th>Phenotypes Week 8 of reinfection</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average FEC at 210d (epg)</td>
<td>PCV (%)</td>
<td>EOS (cells/ml)</td>
</tr>
<tr>
<td>Resistant</td>
<td>-0.215</td>
<td>204</td>
<td>24</td>
</tr>
<tr>
<td>Sensible</td>
<td>0.134</td>
<td>924</td>
<td>20</td>
</tr>
</tbody>
</table>

**KWtest\(^{(1)}\) significance**

- **: Kruskal-Wallis test significance, \(P<0.01\)
- *: \(P<0.05\)
- **: \(P<0.01\)
- ns: not significant

(1) Kruskal-Wallis test significance \(\circ P<0.1; * P<0.05; ** P<0.01; \text{ns not significant}\)
Results

Evolution of immunoglobulin response

>FEC low (week 7) : higher levels of IgA and IgG in resistant animals
  IgE no significant differences

>FEC increased (week 8) : higher levels of IgE in resistant animals
  Significant increase in the serum level of Ig

Induction of Ig response not dependent on the worm burden but on prolificacy of female worms?
## Results

### Characteristics of *H. contortus* worm burden measured at Week 8 of reinfection

<table>
<thead>
<tr>
<th>Kid status</th>
<th>L4 Juvenile worms</th>
<th>Adult worms</th>
<th>Female prolificacy</th>
<th>Juvenile/adult ratio</th>
<th>Total worm burden</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resistant</td>
<td>198</td>
<td>2126</td>
<td>216</td>
<td>59</td>
<td>36.5</td>
</tr>
<tr>
<td>Sensible</td>
<td>10</td>
<td>636</td>
<td>733</td>
<td>83</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>KWtest significance</th>
<th>**</th>
<th>*</th>
<th>ns</th>
<th>ns</th>
<th>***</th>
<th>ns</th>
</tr>
</thead>
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<tr>
<td>(1) Kruskal-Wallis test significance</td>
<td>* ( P&lt;0.05 ); ** ( P&lt;0.01 ); *** ( P&lt;0.001 ); ns not significant</td>
<td></td>
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</tr>
</tbody>
</table>

> 20 times more L4 in resistant kids

> juvenile/adult ratio 15 times higher in resistant kids

➢ resistance occurred by controlling worm maturation?
Results

> IgG and IgA at week 7 positively correlated with the number of immature worms (0.61 $P<0.10$ and 0.78 $P<0.01$)

> Lower FEC in resistant animals at week 7 and 8 not correlated with female prolificacy measured at week 8.

➢ Ig : an indicator of the number of immature worms?

➢ the precise function of Ig in the control of worm maturation?
Conclusion

> Results on immunological response to strongyles in goats are very scarce

> Despite a reduced genetic segregation between resistant and sensible kids and the complexity of working in natural infection:

- Intensive immune response against *H. contortus* occurred in more resistant kids

- Underlying mechanisms of delayed worm maturation and lower prolificacy?