Are the consequences of coccidiosis affected by selection for improved performance?

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Background

• Chicken coccidiosis adversely impacts broiler performance

• Reduced growth rate caused by anorexia and reduced efficiency of feed utilization
  - reduced nutrient absorption
  - alterations in post-absorptive utilization

• *E. maxima* one of the most common sp. affecting the proximal intestine

• Malabsorptive type coccidiosis may affect Ca and P absorption and potentially impact bone mineralization

• Intensive selection for increased average daily gain and reduced FCR may affect bone mineralization
Aims and Hypothesis

• We aimed at comparing two genotypes differing in their growth rates (>25%) and FCR (>10%), infected with two levels of *E. maxima* during the grower phase

• We hypothesized

  ➢ Birds of the slow growing genotype (S) will show higher degree of mineralization than birds of a fast growing genotype (F), irrespective of infection status

  ➢ *E. maxima* will reduce bone mineralization in both genotypes and effects will be more pronounced at increased pathogen doses

  ➢ Effects of *E. maxima* will be more pronounced in the Fast (F) growing genotype than the (S)
Material and Methods

• 144d-old Ross 308 (F) chicks male chicks and 144 Ross Ranger (S) male chicks

• 2 phase dietary scheme according to Aviagen recommendations; starter (1-10), grower (11-25)

• Oral inoculation with a single 0.5-mL oral dose of water (C), $2 \times 10^3$ (L), or $7.5 \times 10^3$ (H) of sporulated *E. maxima* oocysts at 13d of age
Material and Methods

- Pen ADG, ADFI and FCR were calculated over the pre-patent (d1-4), acute (d5-8) and recovery phase (d9-12) of infection and calculated as the percentage difference to their respective controls.

- 1 bird/pen was weighed and dissected on d6 (acute) and d13 PI (recovery period) (n=8).

- Tibia and femur excised for determination:
  - Dry defatted bone weight (DDB; g/kg BW)
  - Ash content (g/kg BW)
  - Bone breaking strength of femur and tibia (BBS; N/kg BW)
  - Percentage bone ash (%)

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H and L birds showed reduced ADG and ADFI and increased FCR, effects being pronounced during the acute period of infection.
Results-Performance

- Effects of infection were more pronounced for FCR in S than F birds during the acute period of infection.
Results - Genotype

BBS (N/kg of BW)

- **Tibia**
  - D6: NS
  - D13: <0.05

- **Femur**
  - D6: NS
  - D13: <0.05

**Groups:**
- **Slow**
- **Fast**
Results - Genotype

DDB (g/kg of BW)

<table>
<thead>
<tr>
<th></th>
<th>D6</th>
<th>D13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tibia</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Femur</td>
<td>&lt;0.05</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>

- Slow
- Fast
Results-Genotype

D6

<table>
<thead>
<tr>
<th>Ash (g/kg of BW)</th>
<th>Tibia</th>
<th>Femur</th>
</tr>
</thead>
<tbody>
<tr>
<td>D13</td>
<td></td>
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</table>

Tibia Femur Tibia Femur

<0.01 NS <0.05 <0.001

Slow Fast

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## Results - Genotype

<table>
<thead>
<tr>
<th></th>
<th>Tibia</th>
<th>Femur</th>
<th>Tibia</th>
<th>Femur</th>
</tr>
</thead>
<tbody>
<tr>
<td>D6</td>
<td>43</td>
<td>44</td>
<td>46</td>
<td>45</td>
</tr>
<tr>
<td>D13</td>
<td>43</td>
<td>44</td>
<td>46</td>
<td>45</td>
</tr>
</tbody>
</table>

- **Ash (%)**
- **Slow**
- **Fast**
Results-Dose

BBS (N/kg of BW)

<table>
<thead>
<tr>
<th></th>
<th>Tibia</th>
<th>Femur</th>
<th>Tibia</th>
<th>Femur</th>
</tr>
</thead>
<tbody>
<tr>
<td>D6 Control</td>
<td>&lt;0.05</td>
<td></td>
<td>&lt;0.05</td>
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<tr>
<td>Low</td>
<td></td>
<td>&lt;0.05</td>
<td></td>
<td>NS</td>
</tr>
<tr>
<td>High</td>
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</table>

Control
Low
High

NS
Results-Dose

![Graph showing DDB (g/kg of BW) for Tibia and Femur at D6 and D13, with Control, Low, and High groups.]

**DDB (g/kg of BW)**

- **Tibia**
  - D6
  - D13

- **Femur**
  - D6
  - D13

- **Control**
- **Low**
- **High**
Results-Dose

<table>
<thead>
<tr>
<th>Ash (g/kg of BW)</th>
<th>Control</th>
<th>Low</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tibia D6</td>
<td>1.1</td>
<td>1.0</td>
<td>1.2</td>
</tr>
<tr>
<td>Femur D6</td>
<td>0.9</td>
<td>0.8</td>
<td>0.7</td>
</tr>
<tr>
<td>Tibia D13</td>
<td>&lt;0.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Femur D13</td>
<td>NS</td>
<td></td>
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</tbody>
</table>

(Chart showing comparative ash levels for Tibia and Femur at D6 and D13 with control, low, and high groups indicated by bars and statistical significance denoted as NS, <0.1, or NS for control vs. low and high groups.)
Results-Dose

<table>
<thead>
<tr>
<th>Ash (%)</th>
<th>Control</th>
<th>Low</th>
<th>High</th>
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<tbody>
<tr>
<td>38</td>
<td>39</td>
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<td>46</td>
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</table>

**Tibia Femur Tibia Femur**

<table>
<thead>
<tr>
<th>Time</th>
<th>Control</th>
<th>Low</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>D6</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>D13</td>
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Discussion

• ADG and ADFI were reduced to the same extent in birds of the two genotypes.

• Birds of the S genotype overall showed higher degree of bone mineralization both at the level of tibia and femur.

• Infection with *E. maxima* reduced aspects of bone mineralization both at the level of tibia and femur with effects persisting to the end of the recovery period.

• Effects were in general dose independent due to the high pathogenicity of the strain used.

• The impact of infection was similar between the two genotypes.
Further research

- Expand on different pathogen species which may elicit different pathological responses to the host affecting different portions of the intestine.

- Diet offered to genotypes was adequate in nutrients. It would be interesting to investigate responses when offering diets marginally deficient in nutrients involved in bone mineralization.
Thank you
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