Effects of dietary non-starch polysaccharides (NSP) on *Heterakis gallinarum* infection in chicks

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Number of layers kept in floor husbandry in EU

Re-emerging parasitic infections
- *Heterakis gallinarum, Ascaridia galli, Capillaria spp., Tapeworms* [1]

Diets
- Birds with outdoor access can directly consume fiber rich plants
- In organic farming, it is difficult to balance amino acids
- Energy diluted (fiber rich) diets are suggested [2,3]
- Stimulate feed intake
  - Positive effects on animal welfare [4]

[1]: Kaufmann et al., 2010; [2]: Sundrum et al., 2005; [3]: Van de Weerd et al., 2009; [4]: Van Krimpen et al., 2008.
Dietary fiber and parasites

• Influence pig nematodes \(^{[1,2,3]}\)
  – *Trichuris suis*
  – *Oesophagostomum dentatum*

• Poultry parasites??
  – Viscous NSP favor development of *A. galli* \(^{[4]}\)

\(^{[1,2,3]}\): Petkevičius et al., 1997; 2001; 2003; \(^{[4]}\): Daenicke et al., 2009.
Plant polysaccharides

- Major part of dietary fibre
- Cellulose
- Pectins
- Glucans
- Inulin
- Chitin
- Exclude lignin

Non Starch Polysaccharides (NSP)

Insoluble NSP: less fermentable
Soluble NSP: easily fermentable
**Heterakis gallinarum**

<table>
<thead>
<tr>
<th>Predilection site</th>
<th>Caeca</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size, cm</td>
<td>0.7-1.5</td>
</tr>
<tr>
<td>Feeding on</td>
<td>Bacteria [1]</td>
</tr>
</tbody>
</table>

*Histomonas meleagridis* [2]

Objective

Establishment and fecundity of *H. gallinarum* influenced by low and highly fermentable dietary NSP?
Material and methods
### Diets

<table>
<thead>
<tr>
<th>Nutrient (g/kg DM)</th>
<th>CON*</th>
<th>I-NSP</th>
<th>S-NSP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ins-NSP</td>
<td>103</td>
<td>172</td>
<td>104</td>
</tr>
<tr>
<td>Sol-NSP</td>
<td>20</td>
<td>23</td>
<td>95*</td>
</tr>
<tr>
<td>Crude protein</td>
<td>216</td>
<td>199</td>
<td>202</td>
</tr>
<tr>
<td>ME, MJ/Kg DM</td>
<td>13.6</td>
<td>12.6</td>
<td>12.2</td>
</tr>
</tbody>
</table>

**Dilution**

- 8.0 %
- 8.8 %

(*) : Supplied ME and nutrients according to feeding standards for growers (NRC, 1994)

(**) : Composed of inulin (79%), DP=9
Experimental setup (x 3)

Slaughtering

Experimental weeks

CON  I-NSP  S-NSP

N = 670
Experimental setup (x 3)

200

Slaughtering

Experimental weeks

CON
n≈35
n≈45

I-NSP
n≈35
n≈45

S-NSP
n≈35
n≈45

• nematode egg excretion

• Worm burdens

• pH, SCFA
Results

Infection parameters
Average worm burden per bird

*: ab; Tukey, p<0.05; after a mixed model using log-transformed data (P<0.001)
Avg. daily total egg excretion per worms of a bird

Daily eggs per worm

*: abc: Tukey, p<0.05; after a mixed model using log-transformed data (P<0.001, P=0.002, respectively)
Results

Caecal environment
Intracaecal pH

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**P values**

- Diet: 0.001
- Infection: 0.002
- Interaction: 0.210

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*:* abc: Tukey, $p<0.05$; after a mixed model
SCFA pool in caeca

**P values**
- **Diet**: 0.001
- **Infection**: 0.001
- **Interaction**: 0.144

*: abc: Tukey, p<0.05; after a mixed model
Conclusions

- Both NSP diets
  - Favour establishment of the nematode
  - S-NSP additionally enhances worm fecundity

- The effects are probably through
  - Altered gastrointestinal environment
  - S-NSP > I-NSP

- Particular measures of precaution!
  - where;
    - parasites are abundant
    - fiber rich diets are offered
Acknowledgements

Thank you for your attention!