APPROACHING THE MYCOTOXIN PROBLEM FROM THE POULTRY PERSPECTIVE

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She’s not Dr. Hermes…

• PhD Fellow at Oregon State University
• Nutritional toxicology in livestock
• Loves chickens, loves quail more
• Current: avian metabolism of ergot alkaloids

Not Mycoplasma

• Secondary fungal metabolites
• History lesson from the poultry industry
  • Turkey X Disease
• The big fungal players
  • Aspergillus (aflatoxin, ochratoxin)
  • Fusarium (T-2, HT-2, deoxynivalenol, fumonisin, zearalenone)
  • Claviceps (ergot alkaloids)

What mycotoxin problem?

• How big is the problem?
  • Well… that’s the problem
  • Did you feed your feed?
    Did you tell anyone?
• The journey from lot to sample…

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Is there a problem?

“But… birds are resistant to toxins?”

Poultry-specific issues

• Concentrate rich diet
• Dose (g toxin/kg BW)
  • Willingness to eat!
• Scale of production
  • Automation, rapid turnover
• Species-specific toxicity
**Aspergillus** (and *Penicillium*)

- **Primary target:** Liver
  - Ruminal biotransformation
  - Nutrient utilization
    - Calcium (shell and bone)
    - Iron (blood clotting)
    - Lipids (fatty liver)
  - 1 mg/kg increases AFB
  - >5% decreased growth

*Dr. Jean Sander, Merck Manual*

Aflatoxin – the Golden Child

- Only mycotoxin with FDA Action Level

<table>
<thead>
<tr>
<th>Component</th>
<th>Action Level (mg/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn/Peanut</td>
<td>30</td>
</tr>
<tr>
<td>Collard Meal</td>
<td>30</td>
</tr>
<tr>
<td>Corn/Peanut</td>
<td>20</td>
</tr>
<tr>
<td>Collard Meal</td>
<td>10</td>
</tr>
<tr>
<td>Anything but Collard</td>
<td>52</td>
</tr>
<tr>
<td>Anything Dairy</td>
<td>52</td>
</tr>
</tbody>
</table>

- But is aflatoxin still a major concern?

**Ochratoxin**

- Not host plant specific
- Primary target: Kidney
  - Altered calcium metabolism
  - Gout
  - Shell quality
- Immunosuppressive
  - 0.1 mg OTA/kg (Pozo et al., 2013)

**Fusarium** (or Gibberella)

- **Primary target:** Liver
- Rare occurrence for U.S.
- Cool and wet conditions
- Major targets: Liver, immune system
- 1 mg/kg reduced Newcastle titers
- 1 mg/kg reduced egg production, shell quality only at high doses (20 mg/kg)

**T-2 toxin (type A trichothecene)**

- Rare occurrence for U.S.
  - Cool and wet conditions
- Oral and GI lesions
  - Major targets: Liver, immune system
- 1 mg/kg reduced Newcastle titers
  (Kumazawa et al., 2005)
- Immunosuppressive effects
  (Net et al., 2005)

**Biotage**

2016 maximum: .1 mg/kg
**Deoxynivalenol (type B trichothecene)**

- Not as toxic, but most common
- Immune system, oral and GI lesions

Antonissen et al. 2014

**Fumonisins**

- Hot summers + wet winters
- Altered lipid metabolism
  - Systemic effects, especially in brain, skin, GI tissue, liver
- 30mg/kg for breeding poultry / 100mg/kg for broilers (FDA recommendations)

Grenier et al., 2016

**Zearalenone (F-2)**

- Largely resistant
  - Turkeys: yes, reduced production… 100mg/kg (Allen, 1983)
  - Poor bioavailability (~5-10%)
  - Rapid metabolism
    - Chickens: β, Turkeys: α (Devreese et al., 2016)
  - Mechanism of action

<table>
<thead>
<tr>
<th>Samples</th>
<th>Positive</th>
<th>Median (mg/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Corn / Other)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zearalenone</td>
<td>305 / 31</td>
<td>.097 / .035</td>
</tr>
</tbody>
</table>

**Ergot alkaloids**

- One alkaloid is a lonely alkaloid
  - Ergotamine, ergotoxine, ergocornine, lysergic acid, ergonovine, etc.
  - Ergot as an indicator of alkaloid level?
- Long-term exposure
  - Feed refusal (oral lesions)
  - Limb/comb necrosis
  - Reduced egg quality
  - Parasite interactions (are we seeing a theme here?)
  - Varies greatly with individual alkaloids

Humans and other mammals are much more sensitive to ergot alkaloids

**Ergot alkaloids and Coturnix quail**

- Species-specific resistance
  - Coturnix quail & chickens resistant to ergot alkaloids
  - 20% forage intake (USDA, pastured poultry)
Ergot alkaloids and Coturnix quail (cont.)

- Detoxification pathways?
- Where do all the toxins go? ~10% recovery?
- Ergotamine metabolized similarly in chickens? (Dänicke, 2016 & 2017)

What are we looking for?

- Mediocre performance
- Often nondescript
- Reduced disease resistance
- Vaccine non-performance
- Parasite load
- GI lesions
- Personnel health

Questions

(comments as “questions”)

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