Effect of protein source on early turkey performance and gastrointestinal tract development

Megan DeVisser
June 10, 2014
Introduction

- Low energy status at hatch
- Intestinal weight and structure change dramatically during first week post-hatch
- Access to nutrients initiates growth and development

Sklan, 2001
Fully Developed Small Intestine

- **Villus**
  - Growth plateaus at 6 – 8 days

- **Crypts**
  - Well defined by day 2 – 3

Garrett, Gordon, and Glimcher, 2010
Goblet Cells

![Diagram of Goblet Cells](image)
Early Turkey Diets

- High quality
- Protein: 28%
- Energy: 2850 kcal/kg
- Soybean meal: 35 - 45%
- Wheat: 40 – 45%
Ingredients

- Soybean meal
  - Most used protein in poultry diets
    - Pressure to reduce meat products
    - Market for grain-fed products
  - Anti-nutritional factors
  - Wet litter concerns
Objectives

- Determine the feeding value of protein concentrates:
  - Soybean meal (SBM)
  - Canola protein concentrate (CPC)
  - Corn gluten meal (CGM)
  - Fish meal (FM)
  - Porcine meal (PM)
# Ingredients

<table>
<thead>
<tr>
<th>Protein Source</th>
<th>Key Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Canola Protein Concentrate</strong></td>
<td>Low anti-nutritional factors</td>
</tr>
<tr>
<td>Fish Meal</td>
<td>High sodium, calcium, phosphorus</td>
</tr>
<tr>
<td><strong>Porcine Meal</strong></td>
<td>High calcium, phosphorus</td>
</tr>
<tr>
<td>Corn Gluten Meal</td>
<td>Low lysine</td>
</tr>
</tbody>
</table>
Materials and Methods
Treatment Diets

- Digestibility values
- Treatments (as % of protein contained in diet):

<table>
<thead>
<tr>
<th>% Soybean Meal</th>
<th>% Protein Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>100% Soybean Meal</td>
<td>0%</td>
</tr>
<tr>
<td>75% Soybean Meal</td>
<td>25% Canola Protein Concentrate</td>
</tr>
<tr>
<td>75% Soybean Meal</td>
<td>25% Corn Gluten Meal</td>
</tr>
<tr>
<td>75% Soybean Meal</td>
<td>25% Fish Meal</td>
</tr>
<tr>
<td>75% Soybean Meal</td>
<td>25% Porcine Meal</td>
</tr>
</tbody>
</table>
Hatching Eggs

- Hatch turkey eggs at U of S Poultry Centre
- Remove birds hatched every 6 hours
- Equalize number of birds from each hatch window between replications
Environment

- Floor pens
- 20 pens
- 58 birds/pen
- 0 – 21 days
Production Data
Hatch Time on Day 21 Body Weights

![Graph showing body weight changes from E26+10h to E27+22h. Body weight increases with hatch window, with some points labeled with 'a', 'ab', and 'b'.](www.usask.ca)
Body Weights

Day 7

- CPC
- FM
- PM
- CGM
- SBM

Day 14

- CPC
- FM
- PM
- CGM
- SBM
Feed Intake

Day 0 - 7

- CPC: 135 g
- FM: 130 g
- PM: 135 g
- CGM: 130 g
- SBM: 125 g

Day 8 - 14

- CPC: 325 g
- FM: 305 g
- PM: 315 g
- CGM: 315 g
- SBM: 295 g
Gain:Feed

Week

CPC
FM
PM
CGM
SBM

Gain:Feed (g:g)

Week

1
2
3

0
0.2
0.4
0.6
0.8
1

b
ab
ab
a
ab
Total Water Consumption

Water Consumption (g/bird)
Digesta Moisture at 21 Days

CPC
FM
PM
CGM
SBM

Digesta Moisture (%)
Gut Development Data
Gut Architecture

- **Villus Length (μm)**: Hatch (a) > Placement (b) > Day 1 (d) > Day 3 (c) > Day 7 (a)
- **Villus Width (μm)**: Hatch (d) > Placement (d) > Day 1 (c) > Day 3 (b) > Day 7 (a)
- **Crypt Depth (μm)**: Hatch (b) > Placement (b) > Day 1 (a) > Day 3 (b) > Day 7 (b)
Goblet Cells

- Shift in proportion of acidic and neutral goblet cells
  - SBM: higher acidic
  - PM: higher neutral
Conclusions

- Hatch window has important impact on performance
- Partial replacement of SBM in prestarter diets has beneficial effects up to 14 days
- PM results in increased growth rate compared to addition of other protein sources
- No major effects on gut development noted
Questions?