Background

In the United States, the agricultural industry uses feed grade antibiotics to help keep animals healthy and productive. Unfortunately, this practice can lead to antibiotic resistant strains of bacteria. The turkey industry is currently searching for an alternative to antibiotics to promote growth as they have been banned in several countries and consumers are willing to pay more for an antibiotic free product.

Probiotics and prebiotics are two possible alternatives to enhance growth in young turkeys by accelerating intestinal maturity.

- **Probiotics** are live, beneficial species of bacteria that naturally populate the small intestine. Logically, if animals consume probiotics which survive the digestion process, some should colonize the GI tract, preventing harmful species from attaching through competitive exclusion.1

- **Prebiotics** are composed of both protein and carbohydrate. These compounds are intended as a substrate for beneficial bacteria in order to shift the intestinal population away from harmful bacteria. Additionally, mannan-oligosaccharides bind to certain types of pathogens such as E. coli and prevents them from attaching to the wall of the small intestine.2

The health of the gastrointestinal tract can be measured not only by the length and area of absorptive villi, but also by the number and type of goblet cells, a specialized epithelial cell. Goblet cells are responsible for producing mucins, high molecular weight glycoproteins that serve to anchor commensal bacteria and exclude pathogenic species.3 Acidic mucins in particular help prevent bacterial attachment in young birds.2

Hypothesis

Based on previous research,1 the mannan-oligosaccharides present in the Saccharomyces cerevisiae supplement will accelerate intestinal development as measured by both villus parameters and acidic goblet cell count.

Methods

Turkeys were raised and euthanized by Stephanie Loeffler. All poults were fed adequate commercial diets. Three commercial supplements were provided:

- Probiotic A - *Bacillus subtilis*
- Mannan-Oligosaccharide from Brewer’s yeast extract
- Probiotic B - *Bacillus licheniformis*

Sections between the ileo-cecal junction and Meckel’s diverticulum were collected upon euthanization at 11 days post hatch.

Blocks were sectioned by OSU CPMPSR Histology/IHC Core Lab. Slides were stained with Alcian Blue pH 2.5 to highlight acidic goblet cells. Measurements and goblet cell counts were done with image J software. Statistical analysis was performed with SAS using ProcGLM.

Results

<table>
<thead>
<tr>
<th>Diet</th>
<th>Villus HT (µm)</th>
<th>Villus Area (µm²)</th>
<th>Crypt Depth (µm)</th>
<th>Acidic Goblet Cells (no.)</th>
<th>Cell Density Height (no./µm)</th>
<th>Cell Density Area (no. x 10^3/µm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>1038</td>
<td>286617</td>
<td>205</td>
<td>42.4</td>
<td>.041</td>
<td>.151</td>
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<tr>
<td>Probiotic A</td>
<td>949</td>
<td>208854</td>
<td>175</td>
<td>46.8</td>
<td>.050</td>
<td>.237</td>
</tr>
<tr>
<td>MOS</td>
<td>1019</td>
<td>269796</td>
<td>211</td>
<td>50.5</td>
<td>.051</td>
<td>.202</td>
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<tr>
<td>Probiotic B</td>
<td>1021</td>
<td>256081</td>
<td>205</td>
<td>52.1</td>
<td>.052</td>
<td>.216</td>
</tr>
</tbody>
</table>

Pooled SEM: 6 4772 2 0.6 0.001 0.005

Analysis of Variance

<table>
<thead>
<tr>
<th>Diet</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>0.122</td>
</tr>
<tr>
<td>Probiotic A</td>
<td>0.001</td>
</tr>
<tr>
<td>MOS</td>
<td>0.001</td>
</tr>
<tr>
<td>Probiotic B</td>
<td>0.001</td>
</tr>
</tbody>
</table>

Figure 2. Results of statistical analysis. Superscripts represent Duncan’s multiple mean separations, with p < .05 as the threshold of significance.

Control Probiotic A MOS Probiotic B

According to data on goblet cell number and density, all three treatments increased acidic goblet cells over the control. In terms of area, Probiotic A acidic goblet cell density was significantly higher than all other groups. Probiotic A acidic goblet cell number was lower than the other treatments but significantly higher than the control. Thus, all groups showed improvement over the control.

- Probiotic A had significantly lower villus area and crypt depth. This group also had lower villus height, although this number was not significant. This was most likely due to natural variation in population because logically a probiotic should not harm intestinal development.

Conclusions

- The Effect of Prebiotic and Probiotic Supplementation on Intestinal Maturity in Turkey Poults

References


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