Utilization of a probiotic-hemicellulases combination to prevent effects of Salmonella contamination of broilers

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Introduction
Salmonella spp. remains a major cause of foodborne illness in humans worldwide. These may be carried asymptomatically in the alimentary tract of live poultry, while deteriorating growth performances, and then spread via the slaughter process to raw, finished products. Among the strategies proposed to prevent intestinal colonization of poultry with Salmonella spp. is the use of enzymes such as hemicellulases (Remus, 2003) and microorganisms with probiotic potential (Pascual et al., 1999). Nevertheless, little is known about the effect of these products on performance parameters of the birds.

Objective
The objective of the study was to determine the effectiveness of a combination probiotic - hemicellulases by its relative incidence on gastrointestinal (GI) tract microbiota, correlated to the animal performances during the growing period of broilers infected or not with Salmonella typhimurium.

Materials & Methods
Five groups of 54 male Cobb broilers were used in this experiment, conducted in a environmentally controlled room, with 6 birds/cage and 9 cages/treatment. One group consists of uninfected broilers fed with the basal diet (T-), and 4 groups are composed of Salmonella infected birds, with the basal diet for each group containing either 100 ppm of hemicellulase preparation (E), 10^6 cfu/g diet of powdered probiotic (P), 100 ppm of hemicellulase preparation + 10^6 cfu/g diet of powdered probiotic (PE), or no additive (T+). Probiotic strain was also administered to the birds by spraying at the hatchery with a probiotic suspension of 10^8 cfu/ml. Chicks were infected at 3 days of age with 10^8 cfu of Salmonella per chick by oral gavage, in combination with a heat stress to intensify stress conditions for birds. Body weight and feed consumption are measured at 7, 14, 21 and 28 days of age. The relative incidence on GI tract microbiota of the different treatments was realized using Fluorescence In Situ Hybridization (FISH)(Harmsen et al., 2002), with a set of 16S rRNA oligonucleotides probes targeted against almost all bacteria (Eub338), Lactobacilli/Enterococci (Lab158), Clostridia (Chis150/Cli135) and E. faecalis/E. faecium (Enf13/Enf2). The total number of cells was determined by staining with 4’,6-diamidino-2-phenylindole (DAPI) for hybridization control. Feces samples were collected from 3 cages for each treatment.

Results & Discussion

Zootecnnical performances
Effects of diet additives on performances are similar whatever the age period of broilers(Table 1). The infection pattern leads to a deterioration of the weight gain and the FCR by 36.8% and 38.9% respectively, in comparison with uninfected birds. The probiotic and the hemicellulases preparation significantly increase the performances of infected birds, with approximately the same body weight gain and FCR improvement for the 2 additives (+5.5% and +4.8% respectively). Moreover, combination of probiotic strain and hemicellulases significantly intensifies the growth performances improvement, increasing body weight gain by 17.1% and decreasing FCR by 7.2%, in comparison with non treated infected birds.

Table 1: Growth performances of broilers infected or not with Salmonella and fed a diet supplemented or not with hemicellulases and/or probiotic

<table>
<thead>
<tr>
<th>Performances</th>
<th>Diet</th>
<th>T-</th>
<th>T+</th>
<th>E</th>
<th>P</th>
<th>T+ PE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial weight (g)</td>
<td>134.8</td>
<td>136.9</td>
<td>143.5</td>
<td>131.4</td>
<td>134.6</td>
<td></td>
</tr>
<tr>
<td>Final weight (g)</td>
<td>1437</td>
<td>986</td>
<td>1060</td>
<td>1083</td>
<td>1145</td>
<td></td>
</tr>
<tr>
<td>Daily weight gain (g/d)</td>
<td>64.22</td>
<td>41.89</td>
<td>45.79</td>
<td>46.79</td>
<td>49.79</td>
<td></td>
</tr>
<tr>
<td>FCR</td>
<td>1.17</td>
<td>1.40</td>
<td>1.31</td>
<td>1.31</td>
<td>1.28</td>
<td></td>
</tr>
</tbody>
</table>

Means on the same line with different letters differ at the 5% level of significance

Microbial diversity analysis
Enumeration of genera Clostridia, Enterococci/Lactobacillus, Bifidobacteria and E. faecalis/E. faecium bacteria in feces samples shows significant differences between the treatments (Fig 1).

Conclusions
Our data show that the probiotic-hemicellulases combination reduced the salmonellose effects on broilers. Future research will involve the effectiveness of this combination against Salmonella cecal colonization.

References

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