Effect of organic acids and mannanoligosaccharide on excretion of Salmonella typhimurium in experimentally infected growing pigs


A R T I C L E   I N F O

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The effect of organic acids and mannanoligosaccharide addition to the diet was assessed in pigs orally inoculated with Salmonella typhimurium. Forty-six growers were distributed among four treatments: Basal Diet (BD); BD + encapsulated organic acids; BD + free organic acids; BD + mannanoligosaccharide. Seroconversion was monitored, and feces and tissue samples were tested for Salmonella isolation. No treatment prevented the carrier state, but a tendency of lower fecal excretion was observed in the group treated with mannanoligosaccharide.

The protocol was approved by the Research Ethics Committee of Universidade Federal do Rio Grande do Sul (number 2007–962).

Two weeks after housing, pigs were orally challenged (day 0 post-inoculation, 0 PI) with a 10 mL-dose of a S. typhimurium suspension (106 colony forming units/mL). Two pigs from the control group died due to Streptococcus suis meningitis before the inoculation and were not replaced. Blood and fecal samples were collected on days 14 and 7 before inoculation and on days 0, 3, 7, 14, 21, 28, 35 PI. On day 35PI, animals were weighed, euthanized, and samples of blood and organs were collected. Samples were submitted to the ISO6579 Salmonella isolation protocol. Fecal samples were tested following the ISO6579 Annex D (ISO, 2007). Quantification of Salmonella was performed in feces samples by the Most Probable Number method, according to BAM (2003). Serum samples were tested by an indirect IgG-ELISA assay based on somatic antigen 1, 4, 5 and 12 of Salmonella (Kich et al., 2003). Results were analyzed by the MIXED or the FREQ procedures of SAS (2002).

All treatment groups were infected, as evidenced by the isolation of Salmonella and by the seroconversion. The mean pig live weight increased in the four groups from 11.39 (±1.6) on the day of housing to 52.11 (±5.5) on day 35PI. Seroconversion started on day 7PI, and IgG titles increased significantly (∼0.05) until day 35PI in all groups.

The frequency of Salmonella excretion varied from 100% (10/10) on day 7PI in the control group to 25% (3/12) on day 28PI in the MOS group. No statistical difference was observed between groups throughout the experiment (Table 1). Results of Salmonella quantification showed interaction between treatment and

* Corresponding author. Address: Faculdade de Veterinária, UFRGS, Av. Bento Gonçalves 9000, Porto Alegre, RS 90540-000, Brazil. Tel.: +55 51 3308 6123; fax: +55 51 3308 7305. E-mail address: mcardoso@ufrgs.br (M. Cardoso).

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Table 1
Frequencies of Salmonella fecal excretion in pigs fed with a basal diet (CON) or with a diet added of encapsulated organic acids (EOA), non-encapsulated organic acids (SOA) or mannanoligosaccharide (MOS), between days 3 and 28 after oral inoculation of Salmonella Typhimurium (DPI).

<table>
<thead>
<tr>
<th>DPI</th>
<th>CON (n = 10)</th>
<th>EOA (n = 12)</th>
<th>SOA (n = 12)</th>
<th>MOS (n = 12)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>7</td>
<td>11</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>7</td>
<td>10</td>
<td>10</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>14</td>
<td>6</td>
<td>7</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>21</td>
<td>7</td>
<td>7</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>28</td>
<td>7</td>
<td>5</td>
<td>6</td>
<td>3</td>
</tr>
</tbody>
</table>

Means followed by different lowercase letters (a, b, c) in the same line are different by t-test (P < 0.05).

Means followed by different capital letters (A, B, C, D) in the same column are different by t-test (P < 0.05).

P = 0.057 ± 0.20

Table 2
Quantification of Salmonella (log_{10} ufc g^{-1}) in fecal samples from pigs fed a basal diet (CON) or a diet added of encapsulated organic acids (EOA), non-encapsulated organic acids (SOA) or mannanoligosaccharide (MOS), between days 3 and 28 after oral inoculation of Salmonella Typhimurium (DPI).

<table>
<thead>
<tr>
<th>DPI</th>
<th>CON</th>
<th>EOA</th>
<th>SOA</th>
<th>MOS</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>0.61 ± 0.31Aa</td>
<td>5.75 ± 1.37Ac</td>
<td>4.39 ± 1.20Abc</td>
<td>1.99 ± 0.83ab</td>
</tr>
<tr>
<td>7</td>
<td>4.06 ± 1.07Aa</td>
<td>3.01 ± 0.81AB</td>
<td>1.93 ± 0.78AB</td>
<td>2.05 ± 0.94</td>
</tr>
<tr>
<td>14</td>
<td>1.61 ± 0.71AB</td>
<td>2.06 ± 0.77BC</td>
<td>0.60 ± 0.28BB</td>
<td>0.77 ± 0.53</td>
</tr>
<tr>
<td>21</td>
<td>1.10 ± 0.14CD</td>
<td>0.64 ± 0.34CD</td>
<td>1.46 ± 0.40CD</td>
<td>0.64 ± 0.33</td>
</tr>
<tr>
<td>28</td>
<td>0.99 ± 0.29Ba</td>
<td>0.64 ± 0.24Ba</td>
<td>0.91 ± 0.33Ba</td>
<td>0.23 ± 0.12b</td>
</tr>
<tr>
<td>P</td>
<td>0.029</td>
<td>&lt;0.01</td>
<td>0.0033</td>
<td>0.064</td>
</tr>
</tbody>
</table>

Means followed by different lowercase letters (a, b, c) in the same line are different by t-test (P < 0.05).

Means followed by different capital letters (A, B, C, D) in the same column are different by t-test (P < 0.05).

P = 0.057 ± 0.20

Day-post-inoculation (DPI, P = 0.0056). Three groups (CON, EOA, SOA) presented an excretion peak of Salmonella after day 3PI, followed by a gradual decrease in fecal excretion until day 28PI (Table 2). The MOS group showed a trend of low excretion throughout the experiment, and on day 28PI it had significantly less Salmonella in feces than the other groups.

Salmonella was isolated from various tissue samples in all groups, with a frequency ranging from 16.7% (liver from SOA and MOS) to 52.9% (lymph node from CON). Besides the fecal-oral route, invasion through the respiratory tract has been demonstrated (Oliveira et al., 2006), and may be facilitated by the respiratory system (Martín-Peláez et al., 2010). These combined effects might reduce the Salmonella shedding rate in our study. Therefore, the effect of mannanoligosaccharide treatment of carrier pigs upon the infection rates in sentinel pigs deserves further investigation.

Conflict of interest statement
None declared.

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References