Potential of bacteriophage application as an intervention strategy against *Salmonella* in pigs

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**Key word:** phage, lysate, pre-harvest, reduction, dissemination.

**Summary:** Bacteriophage (phage) lysate was used for reducing the dissemination of *Salmonella* in pigs. The phage lysate was administrated into pigs beginning 1 hour after challenge for 2 hours duration. Three hours post challenge, pigs were killed and necropsied. The numbers of *Salmonella* were enumerated in various tissue samples. Administration of the phage lysate lowered the numbers of *Salmonella* by 2 logs as compared to controls in the colon and cecum contents. It suggests that use of phage could be considered as an alternative intervention strategy against *Salmonella* in pigs at the pre-harvest stage with further studies.

**Introduction:** Prevalence of *Salmonella* in pigs may gradually increase during the handling period immediately prior to slaughter (2). In the view of food safety, this rapid increase of *Salmonella* positive pigs at pre-harvest stage becomes a great concern because it increases the risk of *Salmonella* contamination in pork products. Phages have been reported to have therapeutic value in intestinal disease in pigs (4), but some controversy still exists regarding their efficacy (1, 3). Thus, the objective of this study was to evaluate whether phage is able to reduce rapid dissemination of *Salmonella* in pigs.

**Materials and Methods:** *Salmonella typhimurium χ4232 (NalR*) was used for challenging pigs. Ten 3 week-old pigs were randomly assigned into 2 groups. All pigs were intranasally challenged with *Salmonella* (5.6 x 10⁸ CFU). One hour post challenge, pigs in the principle group received 6ml of the phage lysate (1.5x10¹⁰ PFU/ml) via IM injection and 20 ml orally. Twenty ml of the phage lysate were subsequently administrated every 30 minutes during 2 hours after initial phage administration. Pigs in the control group received *Salmonella* culture lysate in a similar manner to those in the principle group. Three hours post challenge, all pigs were killed and necropsied and tissue samples collected (blood, tonsil, lung, liver,
spleen, ileocecal lymph node, colon and cecum contents). The numbers of *Salmonella* were quantified on XLD plates with nalidixic acid.

**Results and Discussion:** Because the rapid increase of *Salmonella* in pigs prior to slaughter is believed to be an important factor associated with increasing *Salmonella* contamination in pork, effective intervention strategies are needed. Administration of phage lysate reduced the dissemination of *Salmonella* in pigs within 3 hours post challenge (Figure 1). The present study evaluated the efficacy of a broad host range phage lysate administered by 2 routes simultaneously. Although phage therapy has resulted in variable results for treatment of diseases per se, the use of phage for decreasing the level of rapidly disseminated *Salmonella* poses an intriguing potential food safety intervention alternative. The reduced level of *Salmonella* in gut contents of some pigs encourages further studies (Table 1).

**Literature cited**


Figure 1. The numbers of *Salmonella* in pig's tissues administrated with phage lysate 1 hour post *Salmonella* challenge (5.6 x 10⁹ CFU) in 3 week-old pigs.

Table 1. The numbers of pigs whose samples harbor the low numbers of *Salmonella*

<table>
<thead>
<tr>
<th>Experimental Group</th>
<th>Numbers of animals with <em>Salmonella</em> of ≥10⁴ CFU/g of samples</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Colon content</td>
</tr>
<tr>
<td><em>Salmonella</em> control</td>
<td>4/4</td>
</tr>
<tr>
<td>Phage treated group</td>
<td>1/5</td>
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</tbody>
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