

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

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Summary

Bacteriophage (phage) lysate was used for reducing the dissemination of *Salmonella* in pigs. The phage lysate was administered into pigs beginning 1 hour after challenge for 2-hour duration. Three hours postchallenge, 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 compared with 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 preharvest stage with further studies.

Introduction

Prevalence of *Salmonella* in pigs may gradually increase during the handling period immediately before slaughter (2). In the view of food safety, this rapid increase of *Salmonella* positive pigs at preharvest 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

S. Typhimurium χ 4232 (Nal^R) was used for challenging pigs. Ten 3 week-old pigs were randomly assigned two groups. All pigs were intranasally challenged with *Salmonella* (5.6×10^9 CFU). One hour postchallenge, pigs in the principle group received 6 ml of the phage lysate (1.5×10^{10} PFU/ml) via i.m. injection and 20 orally. Twenty ml of the phage lysate was subsequently administered 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 postchallenge, 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 before 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 postchallenge (Figure 1). The present study evaluated the efficacy of a broad host range phage lysate administered by two 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).

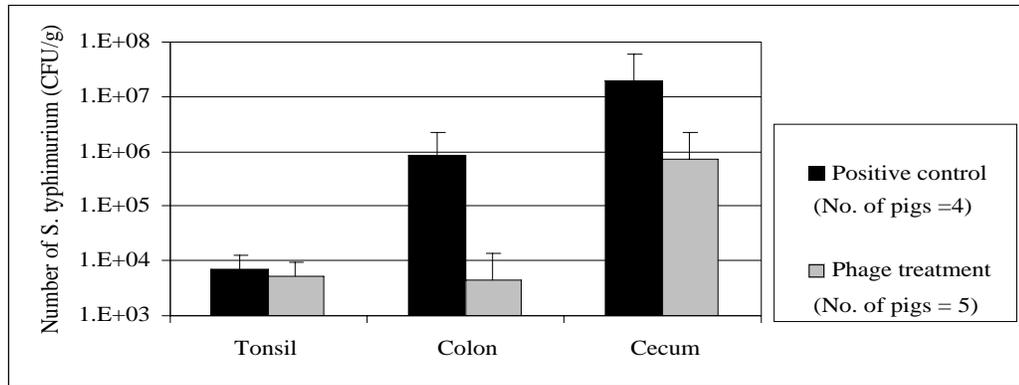


Figure 1. Numbers of *Salmonella* in pig’s tissues administrated with phage lysate 1 hour post-*Salmonella* challenge (5.6×10^9 CFU) in 3 week-old pigs.

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

Experimental Group	Numbers of animals with <i>Salmonella</i> of $\geq 10^2$ CFU/g of samples	
	Colon content	Cecum content
<i>Salmonella</i> control	4/4	4/4
Phage treated group	1/5	3/5

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