Evaluation of a lytic bacteriophage, Φ st1, for biocontrol of Salmonella enterica serovar Typhimurium in chickens

ABSTRACT

In this study, a Salmonella Typhimurium lytic bacteriophage, ū st1, which was isolated from chicken faecal material, was evaluated as a candidate for biocontrol of Salmonella in chickens. The morphology of ū st1 showed strong resemblance to members of the Siphoviridae family. ū st1 was observed to be a DNA phage with an estimated genome size of 121 kbp. It was found to be able to infect S. Typhimurium and S. Hadar, with a stronger lytic activity against the former. Subsequent characterisation of ū st1 against S. Typhimurium showed that ū st1 has a latent period of 40 min with an average burst size of 22 particles per infective centre. Approximately 86.1% of the phage adsorbed to the host cells within the initial 5 min of infection. At the optimum multiplicity of infection (MOI) (0.1), the highest reduction rate of S. Typhimurium (6.6 log10 CFU/ml) and increment in phage titre (3.8 log10 PFU/ml) was observed. ū st1 produced adsorption rates of 88.4ï 92.2% at pH 7ï 9 and demonstrated the highest bacteria reduction (6.6 log10 CFU/ml) at pH 9. ū st1 also showed an insignificant different ($P > 0.05$) reduction rate of host cells at 37 °C (6.4 log10 CFU/ml) and 42 °C (6.0 log10 CFU/ml). The in vivo study using ū st1 showed that intracloacal inoculation of ~ 1012 PFU/ml of the phage in the chickens challenged with ~ 1010 CFU/ml of S. Typhimurium was able to reduce ($P < 0.05$) the S. Typhimurium more rapidly than the untreated group. The Salmonella count reduced to 2.9 log10 CFU/ml within 6 h of post-challenge and S. Typhimurium was not detected at and after 24 h of post-challenge. Reduction of Salmonella count in visceral organs was also observed at 6 h post-challenge. Approximately 1.6 log10 PFU/ml ū st1 was found to persist in the caecal wall of the chicks at 72 h of post-challenge. The present study indicated that ū st1 may serve as a potential biocontrol agent to reduce the Salmonella count in caecal content of chickens.

Keyword: Bacteriophage; Phage therapy; Salmonella Typhimurium; Salmonellosis; Chicken