Effect of dietary supplementation with *Bacillus subtilis* on the growth, performance, immune response and antioxidant activities of the shrimp *(Litopenaeus vannamei*)

Wen-Ying Shen, Ling-Lin Fu,Wei-Fen Li & Yao-Rong Zhu

Abstract: The objective of this study was to evaluate the effect of dietary supplementation of a probiotic bacterium, *Bacillus subtilis*, on the growth, immune response and antioxidant activities of shrimp (*Litopenaeus vannamei*). Shrimps with an average initial weight of 2.11±0.17 g were randomly assigned to four groups with three replicates. The control group was fed a basal diet, and three treated groups were fed diets supplemented with *B. subtilis* at doses of 1×10^4, 5×10^4 and 10×10^4 colony-forming unit (CFU) g^{-1} feed respectively. After 40 days of culture, 10 shrimps from each replicate were taken randomly for the determination of immune response and oxidization resistance indices. The results showed that the shrimps fed with *B. subtilis* at a dose of 1×10^4, 5×10^4 CFUg^{-1} feed showed significantly better growth than that of the control diet. The phenoloxidase activities showed a tendency to increase with an increased dose of *B. subtilis* in diets but there was no significant deference among the three treated groups. In addition, phenoloxidase activities were found to be significantly higher ($P<0.05$) in the groups treated with *B. subtilis* than that of the control group. Shrimps treated with 5×10^4 CFUg^{-1} feed probiotic bacterium showed the highest lysozyme activity and it was significantly higher ($P<0.05$) than the other groups. However, there was no significant deference in acid phosphatase and alkaline phosphatase activity across all the groups. The total antioxidant capacity, superoxide dismutase and glutathione peroxidase activities in the probiotic-treated groups were significantly increased ($P<0.05$) as compared with the control groups. Both maleic dialdehyde concentration and superoxide anion activities in the probiotic-treated groups were significantly lower ($P<0.05$) than those of the control. The probiotic did not affect the nitric oxide synthase and the catalase activity in any of the control and treated groups. These results indicated that the probiotic *B. subtilis* could significantly promote the growth rate of shrimp by increasing the immune function and antioxidant capacity. The most effective dose of *B. subtilis* in the diet was 5×10^4 CFUg^{-1} feed.

Key words: *Bacillus subtilis, Litopenaeus vannamei*, growth, immune response, antioxidant activities