Effects of propolis on the immune enhancement of the formalin-inactivated *Aeromonas salmonicida* vaccine

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Abstract

Furunculosis caused by *Aeromonas salmonicida* is a major threat to salmonids throughout all their life stages. Vaccination against *A. salmonicida* has been shown to provide effective protection in aquaculture. The success of many vaccines relies on their association with the appropriate adjuvant to increase their immunogenicity and ensure long-term protection. In this study, the effects of vaccines using propolis as adjuvants against furunculosis in rainbow trout (*Oncorhynchus mykiss*) were evaluated. The parameters evaluated included the relative percent survival (RPS), the specific IgM antibody level and the expression profiles of several immune-related genes in four tissues following immunization and challenge. The results showed that the experimental vaccines containing propolis as adjuvants (ExpVacPro group) could effectively protect the experimental fish against *A. salmonicida* infection with an RPS of 89.47%. The gene expression data revealed that ExpVacPro could induce the differential expression of the pro-inflammatory cytokines, MHC class Ⅰ, T-cell markers and Ig markers in immunized fish, with higher levels in liver and spleen than in head kidney and gill. ExpVacPro initially increased the expression of *MHC I* and *IL8* genes in related pathways, and then gradually increased the expression of *IL-1β* and *IgT* genes for about 2 weeks. During the post-vaccination challenge, the expression levels of all detected genes were up-regulated especially for *CD8* and *IgT* genes. The specific IgM antibody titres were significantly induced following immunization and challenge. In conclusion, the results indicated that propolis could improve potency and efficacy of formalin-inactivated *A. salmonicida* vaccine as adjuvants.

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