

The effect of single and combined vaccines against *Streptococcus iniae* and *Vibrio harveyi* on digestive enzymes of Asian sea bass (*Lates calcarifer*)

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Abstract

The aim of this study was to investigate the effects of single and combined vaccines against *Streptococcus iniae* and *Vibrio harveyi* on the activity of digestive enzymes in Asian sea bass (In the fall of 1398). The fish were randomly divided into 7 experimental groups including phosphate buffer saline (control), *S. iniae* vaccine by injection, *S. iniae* vaccine by immersion method, *V. harveyi* vaccine by injection, *V. harveyi* vaccine by immersion method, *S. iniae* / *V. harveyi* vaccines by immersion method, *S. iniae* / *V. harveyi* vaccines by injection. All groups were divided into three replications and the duration of the experiment was 60 days. Fish sampling was performed on days 0, 30, and 60 of the experiment. The results of the present study showed a significant increase in the levels of trypsin and alpha-amylase in all groups compared to the control group 60 days after vaccination. Also, immunization of Asian sea bass with the vaccines used caused a significant increase in the level of chymotrypsin in *V. harveyi* vaccine by injection and immersion groups compared to the control group at the end of the experimental period. The results also showed a significant increase in protease enzyme levels in *S. iniae* vaccine by immersion group and lipase enzyme levels in *S. iniae* vaccine by injection, *V. harveyi* vaccine by injection, *V. harveyi* vaccine by immersion, and *S. iniae* / *V. harveyi* vaccines by immersion groups compared to the control group. In addition, a significant increase in alkaline phosphatase enzyme levels was observed in *S. iniae* vaccine by injection and *V. harveyi* vaccines by immersion groups compared to the control group. The results of this study suggest that single and combined vaccines of *Streptococcus iniae* and *Vibrio harveyi*, especially by immersion method, can positively improve the level of digestive enzymes in Asian sea bass juveniles.

Keywords: Immersion vaccines, Injection vaccines, Digestive enzymes, Asian sea bass.