DOI: 10.22055/ivj.2024.476485.2735

The effect of oral administration of encapsulated *Lactiplantibacillus plantarum* on the efficacy and immunogenicity of *Aeromonas hydrophila* vaccine in common carp

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Received: 01.09.2024 Accepted: 18.09.2024

Abstract

In the present study the effect of oral administration of probiotics *Lactiplantibacillus plantarum* in free form and microencapsulated with alginate/chitosan on immunogenicity and efficacy of Aeromonas *hydrophila* vaccine was evaluated in common carp. Three hundred and sixty common carps (48±5.1 gBW) were randomly divided into four equal groups in triplicates. Group 1 was vaccinated against *A. hydrophila*. Group 2 received the same vaccination and was also administered a diet supplemented with *Lactobacillus plantarum*. Group 3 was vaccinated and fed with encapsulated *L. plantarum*. Group 4, serving as the control, was fed with a basic diet without any supplementation. Biometrical measurement, blood and intestinal samples were taken on day zero, 30 and 60 of the experiment. Growth performance indices (Feed conversion ratio, specific growth rate, Protein efficacy ratio and food efficacy ratio) as well as immunological parameters (Antibody titer, serum lysozyme, complement and bactericidal activity, NBT reduction, globulin level and myeloperoxidase activity) were measured and compared among the groups. Meanwhile hematological parameters (Red Blood Cells, White Blood Cells, Hemoglobin and Hematocrit), intestinal enzyme activity (lipase, proteas, amylase and ALP). Antioxidant status (MDA level, SOD, GSH and catalase activity) and some serum biochemical indices (glucose, urea, Ca, Tg, ALP, CPK and Bilirubin) were measured and compared among the groups. On day 60 of the experiment the remained fish in each group were challenged with virulent *A. hydrophila* and cumulative mortality was recorded for 14 days. Results showed that the highest growth indices and intestinal enzyme activity were recorded in group 3 which were fed with encapsulated *L. plantarum*. Most of the immune indices evaluated in the study showed a significant increase in treatments 3 and 2 compared to the control group. The blood parameters and serum biochemical indices did not show significant differences among the groups. The mortality rate after the challenge was significantly lower in treatments 2 and 3 (30%) compared to the control group (60%). Overall, it can be concluded that not only the administration of *L. plantarum* play a role in improving the efficacy and immunogenicity of the injectable *A. hydrophila* vaccine in common carp, but also microencapsulation of this probiotic with alginate/chitosan enhances its effect on the vaccine's efficacy and immunogenicity. Therefore, the use of this microencapsulation method is recommended to improve the efficacy of the probiotic and the vaccine.

Key words: *Aeromonas hydrophila* vaccine, *Lactiplantibacillus plantarum*, Microencapsulation, Common carp, Immunogenicity

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