

## Effects of *Bacillus coagulans* on Growth Performance, Disease Resistance, and HSP70 Gene Expression in Juvenile Gibel Carp, *Carassius auratus gibelio*

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**Abstract :** We studied the effects of *Bacillus coagulans* on growth, nonspecific immune parameters, and disease resistance in juvenile gibel carp. The fish were randomly divided into five groups: a control group fed a basic diet and four treated groups fed the basic diet supplemented with 125, 250, 500, and 1000 mg/kg *B. coagulans*, respectively, for 8 wk. Growth; plasma lysozyme activity; respiratory burst activity of phagocytes (RBAP); and the activity of tumor necrosis factor- $\alpha$  (TNF- $\alpha$ ), interleukin-1 $\beta$  (IL-1 $\beta$ ), and antioxidant enzymes were determined. The group that received 250 mg/kg *B. coagulans* showed an improved protein efficiency ratio, plasma lysozyme activity, superoxide dismutase, and superoxide anion radical scavenging activity and heat shock protein (HSP70) gene expression compared with the control group. Moreover, the 250 mg/kg *B. coagulans* group had a reduced feeding rate, feed conversion ratio, and plasma malondialdehyde content compared with the control group. The weight gain rate, protein efficiency ratio, plasma lysozyme, RBAP, TNF- $\alpha$ , and superoxide anion radical scavenging activity and HSP70 gene expression were significantly increased, whereas the feed conversion ratio was significantly reduced, in the group supplemented with 500 mg/kg *B. coagulans* compared with the control. Artificial infection with *Aeromonas hydrophila* revealed a cumulative mortality in the control group that was higher than that in the 250, 500, and 1000 mg/kg *B. coagulans* groups. The results suggest that feed supplementation with 250–500 mg/kg *B. coagulans* has the potential to stimulate immunity, increase resistance against pathogenic infection, and promote growth in gibel carp.