Effects of combined florfenicol and quercetin to treat acute hepatopancreatic necrosis disease in *Litopenaeus vannamei* caused by *Vibrio parahaemolyticus*

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ABSTRACT

The survival, disease resistance, and immunity of *Litopenaeus vannamei* infected with *Vibrio parahaemolyticus* causing acute hepatopancreatic necrosis syndrome (VP*AHPND*), and treated with quercetin and florfenicol, alone or in combination were evaluated. Compared with either drug alone, the shrimps in the florfenicol and quercetin combination groups showed significantly lower cumulative mortality over 5 days after infection (*p* < 0.05). Moreover, in the drug combination groups, the vibrio density were consistently lower and the immune parameters were consistently higher than those in single drug groups (*p* < 0.05). In the drug combination groups, the hepatopancreatic tubule structure and integrity were better than those in the single drug groups. Thus, the use of florfenicol and quercetin combined improved the survival rate, disease resistance, and immunity of shrimp challenged with VP*AHPND* compared with either drug alone. The use of florfenicol could be reduced to gain an improved therapeutic effect.

INTRODUCTION

With the development of intensive culture and the deterioration of the ecological environment, the occurrence and spread of acute hepatopancreatic necrosis disease (AHPN), have emerged as one of the most serious threats for shrimp aquaculture worldwide today, causing massive mortality and marked production loss. For a long time, antibiotics has been widely used to prevent and control diseases. However, with excessive use of these drugs, issues such as the emergence of drug-resistant microbial strains, environmental pollution, and drug residue accumulation have exacerbated. Medicinal herbs have attracted a lot of attention, because they are safer to aquatic animals and ecofriendly. Thus, to achieve better preventive or treatment effects, and to reduce the use of antibiotics, we focused on the combined utilization of traditional Chinese herbs and antibiotics.

RESULTS

![Fig. 1](image1.png) Cumulative mortality (A) and protection rates (B) of *L. vannamei* in different groups after infection with VP*AHPND*.

![Fig. 2](image2.png) The density of residual VP*AHPND* in the hepatopancreas of shrimp in different groups after injection with VP*AHPND*.

![Fig. 3](image3.png) The total hemocyte counts (THCs) (A), hemocyanin (HEM) concentration (B), and antibacterial activity (C) of shrimp after injection with VP*AHPND*.

CONCLUSIONS

1. The combined used of florfenicol and quercetin improved the immunity of VP*AHPND*-infected shrimp.
2. The combined used of florfenicol and quercetin enhanced the disease resistance of VP*AHPND*-infected shrimp.
3. The immunity and disease resistance of shrimps were improved with the increase of the florfenicol + quercetin dose.