Abstract

Oxidative stress is a major challenge in tilapia aquaculture, which affects fish growth, health, and immunity, creating a need to explore novel supplementation of tilapia feed. The current study explores the growth-promoting and antioxidant potential of Allicin-mediated ZnNPs as a dietary supplement in Nile tilapia (*Oreochromis niloticus*) feed. Tilapia fingerlings were fed with different diets containing ZnNPs, allicin extract, and allicin-mediated ZnNPs at different concentration levels (20, 40, and 60mg/kg) for 90 days. ZnNPs and allicin-ZnNPs conjugates were characterized by using UV-Visible spectroscopy, Fourier Transform Infrared Spectroscopy (FTIR), Zeta-potential, and Particle size analysis (PSA). Growth performance was evaluated by weight gain (WG), percentage weight gain (%WG), feed intake (FI), feed conversion ratio (FCR), feed efficiency (FE), and specific growth rate (SGR), which shows significant improvement in the allicin-ZnNPs conjugate (40mg/kg) supplemented group. Proximate analysis confirmed that the diet supplemented with allicin-ZnNPs conjugate (40mg/kg) was nutritionally balanced with a slight increase in crude protein content. Antioxidant capacity was assessed by DPPH, H_2O_2, and FRP assay, which revealed the highest scavenging activity in Allicin-ZnNPs conjugates as compared to other groups. In vivo antioxidant status was measured by SOD, CAT, and GST enzymes profiling in liver and serum samples, which shows the best results in Allicin-ZnNPs (40mg/kg). Hematological studies on the liver were also performed. It is concluded that D5 with 40mg/kg allicin-ZnNPs conjugates potentially enhanced growth performance, improved antioxidant defence system, and reduced oxidative stress.