Effects of salinity on physiological, biochemical and gene expression parameters of Black Tiger Shrimp (Penaeus monodon): potential for farming in low-salinity environments

ABSTRACT

Salinity is one of the most important abiotic factors affecting growth, metabolism, immunity and survival of aquatic species in farming environments. As a euryhaline species, the black tiger shrimp (Penaeus monodon) can tolerate a wide range of salinity levels and is farmed between brackish to marine water conditions. The current study tested the effects of six different salinity levels (0‰, 2.5‰, 5‰, 10‰, 20‰ and 30‰) on the selected physiological, biochemical and genetic markers (individual changes in the expression pattern of selected candidate genes) in the black tiger shrimp. Experimental salinity levels significantly affected growth and survival performance ($p < 0.05$); the highest levels of growth and survival performance were observed at the control (20‰) salinity. Salinity reductions significantly increased free fatty acid (FFA), but reduced free amino acid (FAA) levels. Lower salinity treatments (0–10‰) significantly reduced hemolymph osmolality levels while 30‰ significantly increased osmolality levels. The five different salinity treatments increased the expression of osmoregulatory and hemolymph regulatory genes by 1.2–8-fold. In contrast, 1.2–1.6-fold lower expression levels were observed at the five salinity treatments for growth (alpha amylase) and immunity (toll-like receptor) genes. O2 consumption, glucose and serotonin levels, and expression of osmoregulatory genes showed rapid increase initially with salinity change, followed by reducing trend and stable patterns from the 5th day to the end. Hemocyte counts, expression of growth and immunity related genes showed initial decreasing trends, followed by an increasing trend and finally stability from 20th day to the end. Results indicate the farming potential of P. monodon at low salinity environments (possibly at freshwater) by proper acclimation prior to stocking with minimal effects on production performance.

Keyword: Hemolymph osmolality; Stress hormone; Gene expression; Osmoregulation