

Pornpun Poompoung 2013: Characterization of Two Constitutive Heat Shock Protein 70 Genes in Bighead Catfish *Clarias macrocephalus* (Günther, 1864): cDNA Cloning and Their Response to Heat Stress and Bacterial Challenge. Doctor of Philosophy (Aquaculture), Major Field: Aquaculture, Department of Aquaculture. Thesis Advisor: Associate Professor Supawadee Poompuang, Ph.D. 137 pages.

Heat shock proteins are ubiquitous, highly-conserved proteins that play a central role in controlling cellular homeostasis in response to a wide range of stresses including heat stress, oxidative stress, heavy metals and viral infection. Two heat shock cognate protein 70 genes were isolated from liver of bighead catfish. The length of complete cDNA sequences for bighead catfish *HSC70-1* and *HSC70-2* were identical with 2,278 bp, with the open reading frame of 1,950 bp encoding a 649 amino acid protein. Amino acid sequences of both proteins shared 94% similarity with 38 substitutions. The two genes were different in genomic DNA length, with 3,178 and 2,909 bp, respectively for *HSC70-1* and *HSC70-2*. Seven introns and eight exons were found in the genomic structure of both *HSC70s*. Bacterial infection induced *HSC70-2* expression in liver and muscle, but not in gills and brain tissues. The increased transcription of *HSC70-2* may indicate their important roles as molecular chaperones under oxidative stress.

Reproductive cycle of female bighead catfish is normally interrupted by the presence of a resting phase which precludes a year-round fry production, posing problem to aquaculture of bighead catfish and their hybrid. This study demonstrated the possibility of using temperature manipulation to stimulate ovarian activities during the resting period for bighead catfish. Ovarian development and monthly change in GSI of females held under pond conditions was monitored over a 1-year period from April 2008 to March 2009. In October, thirteen-month old female fish were collected from earthen pond and exposed to elevated temperatures at 30°C and 35°C under hatchery conditions for six weeks. Ovarian growth was determined at a 2-week interval. Significant variation of mean GSI values ($P < 0.05$) was observed among months with the highest value ($13.91 \pm 3.63\%$) in July. Histological examination of ovaries revealed that in females held under 30°C and 35°C, the number of vitellogenic oocytes progressively increased from 0.5 and 4.7% at week 2 to 4.6 and 19.7% at week 6, whereas in the earthen pond, ovaries remained in resting stage. Exposure to warm temperatures resulted in significant elevations of plasma cortisol but not glucose concentrations. The progression of ovarian development was likely due to the stimulatory effect of increased plasma cortisol on synthesis of yolk protein as inferred from the increased numbers of vitellogenic oocytes. Although fully matured females could not be obtained, the present study suggested that temperature manipulation was probably the practical way to increase the number of maturing females at the end of the reproductive season for bighead catfish.

Student's signature

Thesis Advisor's signature