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Effect of allozyme heterozygosity on basal and induced levels of heat shock protein (Hsp70), in juvenile *Concholepas concholepas* (Mollusca)

Katherina Brokordt [a,b,*], Nicolás Leiva [a,b], Katherine Jeno [a,b], Gloria Martínez [b], Federico Winkler [b,a]

[a] *Centro de Estudios Avanzados en Zonas Áridas (CEAZA), Universidad Católica del Norte, Casilla 117, Coquimbo, Chile*
[b] *Facultad de Ciencias del Mar, Universidad Católica del Norte, Casilla 117, Coquimbo, Chile*

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ABSTRACT

Organisms cope physiologically with extreme temperature by producing heat shock proteins (HSPs). Expression of Hsp70 enhances thermal tolerance and represents a key strategy for ectotherms to tolerate elevated temperature in nature. Synthesis of these proteins, together with other physiological responses to elevated temperatures, increases energy demands. A positive association between multiple and single locus heterozygosity (MLH and SLH, respectively) and individual fitness has been widely demonstrated. In molluscs, MLH can decrease routine metabolic rates and improve energetic status. Juvenile *Concholepas concholepas* live in the intertidal zone and are constantly exposed to temperature fluctuations. Thus, these young individuals are exposed both to thermal risks and the large metabolic costs required to cope with thermal stress. We evaluated the effects of allozyme MLH and SLH on basal (control animals) and induced (stressed animals) levels of the Hsp70 in juveniles *C. concholepas*. Juveniles (n=400) were acclimated at 16 °C for 2 weeks; then 100 animals were exposed to 24 °C (stress) and 100 were kept at 16 °C (control) for 2 and 7 days. The variability of 20 loci was analyzed by starch gel electrophoresis. For SLH effects we used 7 polymorphic loci. We quantified expression of Hsp70 by Western blot analyses. Hsp70 expression increased markedly (~90%) with temperature. We found a positive association between MLH and basal and induced levels of Hsp70 in the 2-day exposure experiment. Regardless of temperature, Hsp70 levels increased with MLH (r^2=0.7 and 0.9, for basal and induced levels, respectively) reaching maximal levels in juveniles with intermediate and high MLH levels (2 and 3 loci), and decreasing slightly (but not significantly) in juveniles with highest MLH (≥4 heterozygous loci). However, after 7 days of exposure to thermal stress, less heterozygous juveniles attained the same levels of Hsp70 than more heterozygous juveniles. Given the faster increment of Hsp70 in *C. concholepas* juveniles with intermediate-high levels of MLH, these individuals could be less affected by thermal stress in the intertidal zone. We found an association between specific loci genotype and higher Hsp70 levels (basal or induced). In comparison to homozygous juveniles, heterozygous juveniles for several loci showed higher Hsp70. However, these associations were not for the same loci in juveniles exposed to high temperature for 2 and 7 days. This suggests genotypic variation at some allozyme loci could be more important in the period of initial response to high temperature and others can be more important in the response to the chronic temperature stress.