Characterization of the respiratory metabolism of juvenile Hippocampus erectus (Perry, 1810) near the limit of thermal tolerance: the effect of magnitude and velocity of temperature change.

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The zone of thermal tolerance (ZTT) is the temperature range in which metabolic activity supplies enough energy to fully satisfy the physiological demands of an individual. Beyond its limits, energy investment becomes less efficient until the basic physiological needs cannot be met and life terminates. We examined oxygen consumption (VO2) and five metabolites in newborn (20 days) and juvenile (1 year) Hippocampus erectus before, during and after they were exposed to an abrupt (10 minutes) or gradual thermal change (12 hours). Temperature was increased from 26°C to either 30°C (within the ZTT), 33°C (beyond the ZTT) or was kept constant at 26°C (control). Immediately after an abrupt exposure to 30°C, VO2 increased 0.4 and 1.27 times in newborn and juvenile seahorses, respectively, but returned to normal levels after 5 hours even when temperature was kept high. By contrast, a sudden exposure to 33°C increased and maintained VO2 in extremely high values (10.1 and 2.6 times, for newborn and juvenile seahorses, respectively). When exposed to gradual thermal change, VO2 increased less and gradually (0.97 and 0.7 times at 30 and 33°C, respectively), and juvenile H. erectus returned to levels near those registered at 26°C. Total proteins and glucose in juvenile seahorses increased markedly, whilst acylglycerides and cholesterol decreased immediately after both abrupt and sudden exposure to 30 and 33°C. Lactate, however, increased in all but those individuals exposed abruptly to 30°C. Results suggest an immediate compensatory response to thermal increments when the final temperature lies within the ZTT.

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