Acid-base balance and ion regulation in spotted ratfish *Hydrolagus colliei* during hypercapnia

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This study was aimed at investigating the net acid–base flux, nitrogenous waste excretion (ammonia and urea) and ion-regulation in marine water spotted ratfish *Hydrolagus colliei* mediated by hypercapnia. Fish were exposed to 1.5% pCO_2 (~15,000 ppm) for a period of 0 h (control), 4 h, 12h, 24 h and 48 h. Extracellular and intracellular pH, plasma pCO_2, bicarbonate concentration, ion status as well as the net flux of acid (H^+), ammonia and urea were determined under the experimentation period. Results show that hypercapnia induced a drastic reduction in intracellular pH (RBC) after 4 h of exposure and thereafter values restored to control level. pH of hepatic tissue remained strictly regulated within the control level. On the contrary, respiratory acidosis resulted in blood pH depression. Blood pH subsided relative to the control throughout the hypercapnia exposure, and was momentarily compensated by an increase in plasma [HCO_3^-]. In addition, these reductions in blood pH were complemented by a parallel increment in plasma TCO_2 level. Ammonia and urea excretion rate remained virtually unchanged during hypercapnia. Likewise, ion-homeostasis was maintained during hypercapnic episodes as no remarkable changes for Na^+ and Cl^- ion levels in plasma were recorded. A slight and temporary increment for net H^+ flux rate was observed. Overall, the present findings suggest that under hypercapnia spotted rat fish prioritize intracellular blood pH homeostasis over extracellular blood pH, and compensated by bicarbonate taken up from the environmental seawater. Furthermore, since the ammonia excretion rate was not increased during hypercapnia and the plasma electrolyte (Na^+ and Cl^-) concentrations remained static, we suggest that these scenarios do not favour the Na^+/ H^+ ion exchange mechanism. In brief, it can be concluded that the additional bicarbonate gained might be a consequence of active HCO_3^-/Cl^- ion exchange against the electrochemical gradient between the fish and the seawater.

keywords: Acid–base, Hypercapnia, Ammonia, Urea, Ion regulation, Proton flux

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