**AMMONIA TOXICITY AND EFFECTS ON GILL (Na\(^{+}\), K\(^{+}\))-ATPASE, V(H\(^{+}\))-ATPASE AND SELECTED OXIDATIVE STRESS ENZYMES IN THE FRESHWATER SHRIMP MACROBRACHIUM AMAZONICUM**

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**INTRODUCTION:** Ambient ammonia in the aquatic environment is usually low owing to bacterial nitrification of ammonia to nitrate and nitrite. NH\(_4^+\) concentrations rarely exceed 5 µM in unpolluted, oxygenated seawater in contrast to hemolymph concentrations of approximately 100 µM in various crab species adapted to different salinities. An effective system of ammonia detoxification or excretion is essential to preserve cellular function and to maintain cellular and body fluid ammonia levels within a tolerable range. **OBJECTIVES:** In present work, we evaluate the effects of total ammonia nitrogen (TAN) on gill (Na\(^{+}\), K\(^{+}\))- and V(H\(^{+}\))-ATPase activities and subunit expression, and on selected oxidative stress enzyme activities in the freshwater shrimp, *Macrobachium amazonicum*. **MATERIAL AND METHODS:** Shrimps were exposed to increasing ammonium concentrations (0, 0.9 or 2.0 mM TAN) for 72 h. Activities of gill (Na\(^{+}\), K\(^{+}\))- and V(H\(^{+}\))-ATPase, and the oxidative stress enzymes superoxide dismutase, glutathione S-transferase, glutathione reductase and glucose-6-phosphate dehydrogenase were assayed spectrophotometrically. Quantitative RT-PCR assays of ATPase expressions were performed using subunit specific primers. The (Na\(^{+}\), K\(^{+}\))- and V(H\(^{+}\))-ATPases were immunolocalized in the gill lamellae. **RESULTS AND DISCUSSION:** Specific (Na\(^{+}\), K\(^{+}\))- and V(H\(^{+}\))-ATPase activities increased after 72-h exposure to 2.0 mM TAN, as did superoxide dismutase, glutathione reductase and glucose-6-phosphate dehydrogenase activities. V(H\(^{+}\))-ATPase B-subunit mRNA expression increased 2.5-fold while (Na\(^{+}\), K\(^{+}\))-ATPase α-subunit expression was unchanged. Increased TAN did not affect (Na\(^{+}\), K\(^{+}\))-ATPase or V(H\(^{+}\))-ATPase distribution in the intralamellar septum and pillar cells. These findings suggest that NH\(_4^+\) excretion is coupled to ATPase activity and the expression of V(H\(^{+}\))-ATPase B subunit mRNA, corroborating models of NH\(_4^+\) excretion in crabs. **CONCLUSION:** The stress response of shrimp to TAN involves alterations other than a simple increase in ATPase activity, such as changes in oxidative stress enzyme activities and gene expression.

**Keywords:** Ammonium stress, stress oxidative enzymes, *Macrobachium amazonicum*

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