

7. CONCLUSION

Since metals are widely distributed in environmental matrices, living bodies including aquatic organisms are exposed to them by either anthropogenic activities or inadvertently by necessity. Heavy metals like lead and arsenic affect various systems. Arsenic and lead mediated cellular response involve marked changes in antioxidant defence system as well as in innate immune response. Functions of intestinal and liver macrophages from lead acetate and sodium arsenite exposed fishes have been examined and any alteration in the antioxidant defence system and innate immune responses have been determined and reported for the first time.

Macrophages constitute the first line of defense against antigenic insults in an organism and also participate in cellular immunity as antigen presenting cells; Cytokines released from macrophages harness the dual branches of immune status viz. humoral and cell mediated immunity. The present study suggests that lead (Pb) and arsenic (As) exert oxidative stress and adversely alters both the defense mechanisms of innate immunity as well as antioxidant system in fish. A variation in morphology and functional activities of macrophages including enzyme release suggests that both the antioxidant and immune defense systems of *C. punctata* intestine are compromised by metals (Pb and As) exposure at low concentrations, probably by compromising the molecular cross-talk between signaling molecules. Suppression of proinflammatory cytokine release (TNF and IL-1b) implicates the involvement of MAPK cascades and downregulation of NFkB genes. The study also reports that a simultaneous exposure to lead and arsenic has a synergistic effect as compared to the effects of independent exposure to them. Also, the alterations in the innate immune functions and antioxidant status with the oxidative stress parameters can be used as potential biomarkers for risk assessment in aquatic ecosystems.

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