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Effect of early-life BPA exposure on maximum swimming speed of zebrafish (*Danio rerio*)

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Swimming performance is a key physiological process important in fish survival. Sensory, neural and muscular systems help in fine-tuning of swimming performance of larval fish. Early-life exposure to endocrine disruptors could perturb key developmental and physiological processes of living organisms. Bisphenol A (BPA) is a well-known endocrine disruptor that perturbs hormonal and metabolic pathways of living organisms through its xenoestrogenic and endocrine disrupting activity. BPA exposure affects growth, development, and reproductive physiology of organisms. BPA is a widely used industrial chemical and its leaching into the environment has made BPA an ubiquitous contaminant in aquatic ecosystems. With the extensive industrial usage and environmental introduction of BPA, it is important to understand the effect of BPA on ecosystem health and physiological impact of BPA in aquatic organisms. This study aims to investigate effects of early-life BPA exposure on maximum swimming speed of the zebrafish model organism. Zebra fish model system is widely used in environmental monitoring and BPA-related studies. During this study, zebra fish were treated for 60 days with two BPA concentrations representing environmentally prevalent doses of 1 and 10 µg/L, and with solvent control (SC) of methanol. Twenty wild-type juvenile zebra fish of age 35 dpf (days post fertilization) were assigned to each tank and treated until maturity in 95 dpf. Each treatment was triplicated. At the end of the treatment period maximum swimming velocity of a randomly selected sample of five fish from each tank was measured using an in-house designed "water flow chamber". The swimming performance of fish in BPA treated tanks was significantly low when compared with the fish in SC tank. Highest mean swimming velocity of 0.26 ms^{-1} was observed in the fish in SC tank, while mean swimming speeds of 0.14 $ms^{-1}$and 0.19 ms^{-1} were recorded in the fish exposed to 10 µg/L and 1 µg/L of BPA respectively. Increasing BPA concentration results in decreased swimming performance of zebrafish as one-way ANOVA analysis of mean swimming speeds is significantly different among the treatments. Early-life exposure to endocrine disrupting chemicals like BPA could affect the muscle, bone and neural development of larval fish affecting the endurance and maximum swimming speed as observed in the BPA-treated tanks. These observations led to the conclusion that early-life BPA exposure imposes significant physiological impact on swimming performance of zebrafish model organism. These highlight the need of more comprehensive studies and confined actions to minimize the environmental introduction of BPA.

Keywords: BPA, Zebrafish, Maximum swimming speed, Water flow chamber, Early-life exposure