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Relationship between biomarkers and endocrine-disrupting compounds in wild
Girardinichthys viviparus from two lakes with different degrees of pollution.

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Abstract:

Despite great efforts worldwide to evaluate the effects of endocrine-disrupting compounds (EDCs) in fish, there is little information available about the interactions of EDCs with the disruption of the sexual endocrine axis in fish species with matrotrophic viviparity and intraluminal gestation. To understand these interactions, six sampling campaigns were performed within a period of 1 year in two lakes with different degrees of pollution. A battery of biomarkers of the oestrogenic response was assessed in the liver [vitellogenin, CYP 1A1, epoxide hydrolase activity, and metallothioneins (MT)] and MT in the head of *Girardinichthys viviparus*. Linear correlation analysis and canonical correspondence analysis were performed to explore the relationship between the oestrogenic response with EDCs and with metals. The biomarker responses were assessed using the water content of EDCs (oestrone, 17- β -oestradiol, oestriol, 17- α -ethinyl oestradiol, total phenols, bisphenol A, nonyl phenol, octyl phenol), as well as the PAHs indene[1,2,3-c,d]pyrene, naphthalene, pyrene, benzo[a]anthracene, benzo[k]fluoranthene and benzo[a]pyrene) and metals (Cu, Fe, Mn, Pb and Zn). Greater disruption of the sexual endocrine axis occurred in fish of both sexes inhabiting the polluted lake whose effects were apparently influenced by CYP 1A1 activity and by 17- α -ethinyl oestradiol. In addition, non-estrogenic mechanisms in the hypothalamus and pituitary glands in male fish were observed, elicited by endogenous levels and the water concentration of Pb. In contrast, in females from the less polluted lake, VTG induction was related to exogenous oestrogens. The disruption of the hypothalamic-pituitary-gonadal axis is a complex process influenced by both endogenous and exogenous factors and contributes to male feminisation by exposure to EDCs.