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## Dietary Supplementation of Garlic, Propolis and Wakame Improves Recuperation in Cadmium Exposed Japanese Medaka Fish (*Oryzias latipes*)

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### Abstract

Deleterious effects due to cadmium (Cd) exposure in fish can become protracted during recuperation, defying the protective capacity offered by endogenous antioxidants. The prospects of exogenous supply of antioxidants from plant based sources have been explored by numerous studies. Based on their immune stimulating and antioxidative merits, the present study was undertaken to assess the ameliorating potentials of dietary supplemented garlic (D1), propolis (D2) and wakame (D3) on Cd bioconcentration and toxicity during recuperation in juvenile medaka fish. Fish were exposed to 0.0 or 0.3 mg l<sup>-1</sup> Cd for twenty one days, during which a control diet (C1) was fed. This was followed by a twenty one day 0.0 mg l<sup>-1</sup> Cd exposure (depuration/recuperation), during which C1 or C2 (positive control diet), D1, D2, and D3 were fed. Results showed antioxidants superoxide dismutase (SOD) and total glutathione (GSH) levels in fish tissues (gill, liver, and muscle) increased significantly following Cd exposure. Values were not significantly restored in the C2 fed groups during recuperation. Furthermore, elevated tissue Cd burden, metallothionein (MT) expression, and lipid peroxidation (LPO) levels were not significantly restored in the C2 fed groups. On the other hand, D1 and D2 elicited significant restoration in elevated tissue Cd burden and LPO levels which supported greater detoxification and recuperation. Condition indices in D1 and D2 fed groups were also significantly higher than D3 and C2 fed groups. In conclusion, dietary supplementation significantly increased recuperation and tissue functions in juvenile medaka fish, with an observed trend of D1>D2>D3.

**Keywords:** Cadmium exposure, depuration, garlic, japanese medaka, *Oryzias latipes*, propolis, recuperation, wakame