

Turmeric extract as a parasiticide for *Ichthyophthirius multifiliis*, *Gyrodactylus* spp. and *Dactylogyrus* spp. on goldfish, *Carassius auratus*

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Protozoan ciliate, *Ichthyophthirius multifiliis* and monogenean flukes, *Gyrodactylus* spp. and *Dactylogyrus* spp. are common external parasites of goldfish, *Carassius auratus*. At high densities of fish, those infestations lead to death and therefore various chemicals with different efficacies are used by farmers as bath treatments. The present study investigated the efficacy of row turmeric (*Curcuma longa*) extract in controlling *I. multifiliis*, *Gyrodactylus* spp. and *Dactylogyrus* spp. on goldfish.

Effective minimum concentration that required to kill *I. multifiliis* in vitro was found out by exposing the parasite to different concentrations of row turmeric extract; toxicity of the turmeric extract on healthy goldfish was tested at a range of concentrations closer to this effective minimum concentration. In vivo effective concentration was found out by exposing infested fish to the same range of concentrations used for the toxicity test; random samples of fish were observed for the presence of parasites two times a day. Anti-parasitic efficacy of the turmeric extract on *I. multifiliis* and both flukes were calculated. Formalin (200 mg l⁻¹) at 4 hours of exposure was used as the positive control while untreated, infested fish were maintained as the negative control.

In vitro effective minimum concentration of turmeric extract on *I. multifiliis* was 250 mg l⁻¹ at 4.5 hours of exposure. Hundred percent removal of *I. multifiliis* and both flukes from the body surface and gills of goldfish was recorded at 270 mg l⁻¹ of row turmeric extract in 3 days of exposure at 24°C-27°C; mean anti-parasitic efficacy (1.571±0.000) on *I. multifiliis* and both monogenean flukes at the end of third day of exposure was not significantly different from the mean anti-parasitic efficacy of formalin at 200 mg l⁻¹ (P>0.05). Severe histological alterations of gill tissue were observed in fish treated with formalin while fewer alterations were seen in fish treated with turmeric extract.