Abstract of the PhD thesis No 27183, Factually of Veterinary Medicine, Urmia University, The Academic year 2025-26

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Title of thesis: I*n vitro* comparative study of cupper nanoparticles, zinc nanoparticles with closantel and Albendazole on *Dicrocoelium dendriticum*

Abstract:

Dicrocoeliasis is a globally significant condition that impacts both economic and public health. The lack of effective vaccines and the emergence of drug-resistant flukes have prompted research into alternative treatments. Metallic nanoparticles have recently been studied for their potential as anthelmintic agents. This research examined the anthelmintic activity of copper oxide (CuO-NPs) and zinc oxide nanoparticles (ZnO-NPs) alongside closantel and albendazole against *D. dendriticum in vitro*. Using adult motility inhibition tests and oxidative stress biomarkers, including glutathione peroxidase (GSH), glutathione S-transferase (GST), superoxide dismutase (SOD), and malondialdehyde (MDA), this study evaluated the effects of CuO-NPs and ZnO-NPs. Flukes were treated with various concentrations of nanoparticles (1, 4, 8, 12, and 16 ppm) for 24 h. The CuO-NPs and ZnO-NPs demonstrated concentration- and time-dependent anthelmintic activity. Higher concentrations (12 and 16 ppm of CuO-NPs; 16 ppm of ZnO-NPs) significantly inhibited worm motility compared to controls, and in comparison, to closantel and albendazole, their effects were comparable. The nanoparticles induced oxidative stress in the flukes, with decreased SOD, GST, and GSH activity and increased MDA levels. Based on these findings, CuO-NPs and ZnO-NPs exhibit potential as therapeutic agents for controlling and treating *D. dendriticum*. However, further studies are necessary to assess their safety and efficacy *in vivo* for managing parasitic infections.

Keywords: *Invitro*, Cu nanoparticles, Zn nanoparticles, Closantel, Albendazole, *Dicrocoelium dendriticum*