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## In Vitro and In Vivo Inhibition of *Helicobacter pylori* by Ethanolic Extracts of Lion's Mane Medicinal Mushroom, *Hericium erinaceus* (Agaricomycetes)

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### Abstract

Natural products are sources for exploratory development of new agents to combat the gastric pathogen *Helicobacter pylori*. Some edible fungi, such as the lion's mane mushroom, have been used for several thousand years to treat digestive diseases. Ethanol-based extractions to prepare *Hericium erinaceus* extracts were tested for growth inhibition ability of six different *H. pylori* strains at an extract concentration that did not inhibit *Escherichia coli* growth, and further for dose-dependent antibactericidal capacity on *H. pylori*. *H. erinaceus* extract exhibited similar growth inhibitory effects on all *H. pylori* strains tested, with a minimum inhibitory concentration of about 2 mg/mL. *H. pylori* survival in phosphate-buffered saline (PBS) was decreased 3 logs by 2 mg/mL extract addition. *H. erinaceus* extract inhibited *H. pylori* adhesion capacity to human gastric epithelial cell line (ATCC CRL-1739) (AGS), even when *H. erinaceus* extract was added at a concentration that affected neither *H. pylori* nor AGS viability. Interleukin-8 (IL-8, representing an immune response factor) in supernatants from AGS and 8-oxo-guanine (8-oxoG, a marker for oxidative DNA damage among the total host cell DNA) were measured from AGS cells exposed to *H. erinaceus* extract before *H. pylori* addition. The subsequent *H. pylori*-mediated immune response (IL-8 production) was significantly ( $P < 0.01$ ) decreased by *H. erinaceus* extract; at 1.0 mg/mL extract addition, IL-8 expression returned to nearly background level (no *H. pylori* added). *H. pylori* infection of AGS caused a 3-fold increase in host 8-oxoG, but this increase was abolished by including 2 mg/mL *H. erinaceus* extract. Mouse colonization assays of C57BL mice were performed on homogenized stomachs 3 weeks after inoculating *H. pylori* into the animals; mice receiving the *H. erinaceus* extract had a mean *H. pylori* load of  $6 \times 10^4$  CFU/g of stomach, about 1 log lower than the control (no extract) animals.

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