

Abstract

An in vitro gut sac technique was used to investigate whether reciprocal inhibitory effects occurred between Cu and Zn uptake in the gastrointestinal tract of the rainbow trout and, if so, whether there was regional variation among the stomach, anterior intestine, mid intestine, and posterior intestine in the phenomena. Metal accumulation in surface mucus and in the mucosal epithelium and transport into the blood space were assayed using radiolabeled Cu or Zn at environmentally realistic concentrations of $50 \mu\text{mol L}^{-1}$ in the luminal saline, with 10-fold higher levels of the other metal (nonradioactive) as a potential inhibitor. Zn transport rates were generally higher than Cu transport rates in all compartments except the stomach, where they were lower. High [Zn] reduced Cu transport into the blood space in the mid and posterior intestines by 67% and 33%, respectively, whereas high [Cu] reciprocally reduced Zn transport into the blood space in these same sections by 54% and 78%. No inhibitions occurred in either the anterior intestine or the stomach. In these segments, elevated concentrations of the other metal stimulated Cu and Zn transport into the blood space and/or the mucosal epithelium by 50–100%, possibly by displacement from intracellular binding sites, thereby raising local concentrations at other transport sites. None of the treatments affected metal accumulation in surface mucus. The results indicate that one or more shared high-affinity pathways (possibly DMT1) occur in the mid and posterior intestine, which transport both Cu and Zn. These pathways appear to be absent from the stomach and anterior intestine, where other transport mechanisms may occur.