Selective Binding of Iron and Copper by Humic Acid Supplements

Reyes, Jocelyn (School: Success Academy DSU)

Humic acid supplements are marketed as natural detoxifiers that claim to bind harmful metals while leaving essential metals unaffected. This study evaluated the selective binding of copper and iron by humic acid supplements under two digestive pH conditions (pH 2 and pH 7). Copper(II) sulfate and iron(II) sulfate solutions were prepared at 100 ppm and adjusted to simulate stomach and intestinal environments. Metal-only controls and metal-plus-supplement treatment groups were prepared for each metal, then also a supplement-only control. After shaking and centrifugation, free metal concentration in the supernatant was measured using spectrophotometry. Ferrozine and bathocuproinedisulfonic acid (BCS) were used to form colored reagents with iron and copper, respectively, allowing concentration through absorbance measurements from the spectrophotometer. Standard calibration curves were used to determine free metal concentrations from absorbance values. Humic acid significantly reduced free metal concentrations ($p < 0.05$). Copper binding measured 0.39 ± 0.02 mg/g at pH 2 and 0.39 ± 0.03 mg/g at pH 7. Iron binding measured 0.23 ± 0.02 mg/g at pH 2 and increased to 0.30 ± 0.06 mg/g at pH 7. An ANOVA test showed that metal type and supplement treatment significantly affected binding ($p < 0.05$), while pH had a smaller overall effect. These findings suggest that humic acid binds copper more strongly than iron. Binding appears to depend more on metal type than digestive pH conditions. Further research is needed to determine whether this binding translates to meaningful detoxification in humans.

Awards Won: