Iron binding by tannic acid: Effects of selected ligands

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Abstract

Foods with high tannin content inhibit Fe absorption from meals. Presumably, tannins form complexes with Fe in the intestinal lumen reducing Fe bioavailability. Our objective was to assess the influence of various ligands on Fe binding by tannic acid *in vitro*. Different mixing sequences were employed to determine whether the ligands could prevent Fe from binding to the tannin or could remove Fe already bound. Solutions of Fe^{+3} (FeC_3 in 0.1 N HCl), ligand (ethylenediaminetetraacetic acid (EDTA), ascorbic acid, nitrilotriacetic acid (NTA) or citric acid) and tannic acid (200 μg ml^{-1}) in pH 4.4 acetate buffer were combined to obtain a final ligand:Fe molar ratio of 1:1 (89 μM). Three mixing sequences were followed: sequence I (Fe and ligand combined and added to tannin); sequence II (tannin and ligand combined and added to Fe); and sequence III (Fe and tannin combined and added to ligand). Fe-tannin binding was assessed by measuring absorbance at 560 nm (visible absorbance maximum) at 15 s intervals for 5 min. An Fe-tannin mixture without ligand served as the control. With EDTA, sequence I resulted in no binding. In sequence II and III, there was some binding initially, but it decreased with time. With ascorbic acid, sequence I resulted in no binding. In sequence II and III, initial binding was slightly lower than the control. Binding did not change with time. With NTA, initial binding varied with the sequence, but converged with time to a value slightly lower than the control. Citric acid did not affect binding regardless of addition sequence. These findings suggest that ligands with high affinity for Fe (e.g. EDTA) can prevent Fe from binding tannin and can remove Fe already bound. Ligands with lower affinity (e.g. citric acid)

have little effect. The implications are that EDTA, ascorbic acid and NTA may affect Fe bioavailability from meals containing tannins.