Iron Bioavailability of Maize Is Improved by Degermination for Some but Not All Genotypes: Enhancing Maize Nutrition With Biofortification and Processing

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Objectives: To evaluate bioavailable Fe, total Fe concentration and phytate concentration of whole and degerminated maize in a diverse panel of 52 genotypes. This work sought to expand upon previous work which identified the germ fraction of the maize kernel as an inhibitory component for Fe bioavailability.

Methods: Samples were degerminated manually by scalpel dissection of the germ fraction. Samples were then cooked, lyophilized, and milled to a flour. Iron bioavailability was evaluated with the Caco-2 Cell Bioassay. Iron concentration was measured by ICP-ES. Phytate concentration was determined via a colorimetric assay for total phytate phosphorous (Megazyme Phytate Kit, Megazyme International).

Results: In 30 of the maize genotypes, bioavailable Fe increased when degerminated, thus indicating a higher fractional Fe uptake as the amount of Fe decreased by more than 70%. The remaining 22 genotypes showed no change or a decrease in Fe bioavailability with degermination. These results confirm previous research showing that the germ fraction is a strong inhibitory component for many maize varieties. Degermination greatly reduced phytate content and phytate:Fe molar ratio; Fe concentrations were positively correlated with phytate, and negatively correlated with phytate:Fe molar ratios for most maize groups. While the high phytate content of the germ fraction likely plays a role, only degerminated yellow maize indicated a significant correlation between Fe bioavailability and phytate concentration, and only pigmented maize indicated a correlation between Fe bioavailability and phytate:Fe molar ratio. Other factors in the maize germ and endosperm fractions are likely relevant to changes in Fe bioavailability.

Conclusions: This study suggests that Fe nutrition from maize can be enhanced by processing (degermination) and or by selecting varieties where the inhibitory effect of the germ fraction is relatively low.

Funding Sources: Funded by the United States Department of Agriculture, Agricultural Research Service.