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The Effect of Bean Polyphenols on Human Iron Absorption

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Abstract

Background: Low iron absorption from common beans contributes to iron deficiency in countries where bean is a staple food. High levels of phytic acid (PA) and polyphenols (PP) inhibit iron absorption, however the effect of bean polyphenols on iron absorption in humans has not been demonstrated and, with respect to variety selection, the relative importance of PP is unclear.

Objective: With the overall aim of increasing the intake of bioavailable iron from beans by plant breeding strategies, this project evaluates the relative importance of polyphenols on iron bioavailability from beans in humans. Two stable iron absorption studies were carried out. Study one evaluated the potential dose dependant effect of bean polyphenols on iron absorption and study two was conducted to evaluate if the effect of polyphenols is overruled by the inhibitory effect of phytic acid in a bean consuming population.

Design: In study 1, three different amounts of bean hulls, as the source of polyphenols, were added to a non inhibitory test meal and iron absorption was measured. 48 subjects were randomly assigned to three groups of 16 subjects each. Group A received 20mg, group B 50mg and group C 200mg of bean polyphenols (expressed in Gallic acid equivalents; GAE). In study 2, two different bean varieties, with the same iron and phytic acid contents, but with strongly differing polyphenol concentrations (5:1) were fed and absorption was measured. 20 subjects from Butare, Rwanda were randomly assigned to begin with the high or the low polyphenol bean.

Results: Study 1: Iron absorption was lowered by 14% with 50 mg GAE ($p < 0.05$); and by 45% with 200 mg GAE ($p < 0.001$). The results of study two are summarised in Fig. 1. Iron absorption from the low polyphenol bean was 4.7% and absorption from the high polyphenol bean was 27% lower ($p < 0.002$); equivalent to 3.4%.

Conclusion: In countries where beans are a staple food, PP content should be considered when selecting bean varieties for human consumption.

Keywords: Biofortification, common bean, iron, polyphenols