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ORIGINAL RESEARCH COMMUNICATION

Production of stable-isotope-labeled bovine heme and its use to measure heme-iron absorption in children[1,2,3,4]

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Background: The use of stable isotopes has provided valuable insights into iron absorption in humans, but the data have been limited to nonheme iron.

Objective: Our objectives were to produce heme iron enriched in ^{58}Fe and to use it to study the absorption of heme iron and the effect of iron and zinc intakes on heme-iron absorption in children.

Design: Labeled bovine heme was produced in a bovine model. Forty-eight children were randomly assigned to consume identical meals containing 1 of 3 doses of labeled heme iron (2, 4, or 8 mg as hemoglobin) and 1 of 2 doses of inorganic zinc (1 or 9 mg); successful measurements of iron absorption, zinc absorption, or both were made in 40 of these subjects. We hypothesized that fractional heme-iron absorption would decrease as heme-iron intake increased and that higher zinc intakes would decrease heme-iron absorption.

Results: ^{58}Fe heme was produced with an enrichment (mass/mass) of 9.5%. Fractional iron absorption in children was significantly affected by the intake of heme iron (P = 0.0013) and of zinc (P = 0.0375), but, contrary to expectations, heme-iron absorption was higher at higher zinc intakes. Absolute heme-iron absorption was higher in the group with higher zinc intakes, but only for those with the lowest heme-iron intake (2 mg; P = 0.0147). Although fractional zinc absorption decreased as zinc intake increased (P = 0.031), absolute zinc absorption continued to increase across the intake range studied (P = 0.018).

Conclusions: Heme iron intrinsically labeled with ^{58}Fe can be produced at sufficient enrichments for use in human studies. In children, heme iron and zinc absorption decrease as the dose of each mineral increases. Heme iron did not inhibit zinc absorption. At lower heme intakes, zinc intakes may increase heme-iron absorption.

Key Words: Iron absorption • zinc absorption • heme iron • stable isotope • children