Iron absorption in man
-
Diet modification
and
Fortification

Akademisk avhandling

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av

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I. Hoppe M, Hulthén L, Hallberg L. **Serum iron concentration as a tool to measure relative iron absorption from elemental iron powders.** *Scand J Clin Lab Invest* 2003;63:489-96

II. Hoppe M, Hulthén L, Hallberg L. **The validation of using serum iron increase to measure iron absorption in man.** *Br J Nutr* 2004 92:485-8

III. Hoppe M, Hulthén L, Hallberg L. **The relative bioavailability in humans of elemental iron powders for use in food fortification.** *Eur J of Nutr* 2006; 45,(1),37-44.

IV. Hallberg L, Hoppe M, Andersson M, Hulthén L. **The role of meat to improve the critical iron balance during weaning.** *Pediatrics* 2003 Apr;111(4 Pt 1):864-70

V. Hoppe M, Hallberg L, Hulthén L. **The importance of bioavailability of dietary iron in relation to the expected effect on iron fortification.** *Eur J of Clin Nutr* 2007 May 30 [Epub ahead of print]

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IRON ABSORPTION IN MAN
- Diet modification and Fortification

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Background: Iron (Fe) deficiency is globally the most common form of nutrient deficiency. The approach to combat this problem can be divided into two major strategies *a):* increasing the dietary Fe bioavailability by diet modification, or *b):* increasing the Fe intake through fortification. However, human bioavailability data on the most commonly used form of Fe fortificants, elemental Fe powders (Fe_{elem}), are limited. The main reason is the lack of methods for measuring absorption from Fe_{elem}. Furthermore, when it comes to the scientific evidence for the comparative effect from each of these two strategies in improving Fe uptake in man, there are still questions.

Aims: To *I):* evolve a method which could be used to characterize the relative bioavailability (RBV) of Fe_{elem} *II):* characterize the RBV of Fe_{elem} fortificants, and finally *III):* study the effect from dietary modifications and/or Fe fortification on Fe absorption and rates of changes in Fe stores.

Methods: To address the given aims the following methods were used in human subjects; Extrinsic labeling with radioactive Fe isotopes and whole-body counting; The area under the serum Fe concentration curve during six hours following administration of 100 mg Fe (S-Fe $AUC_{0\text{-}6h}$). Algorithms based on human data were used as well.

Results: Radioiron absorption and S-Fe $AUC_{0\text{-}6h}$ correlated well (r^2=0.94). The studied Fe_{elem} were all significantly less well absorbed relative ferrous sulfate (RBV=36-65%). Adding 20 g meat, or 20 g meat and 20 mg ascorbic acid to a meal with low Fe bioavailability increased the total Fe absorption with 155% and 227%, respectively. Improvements in Fe status were greater after dietary modifications than after Fe fortification for a diet with low Fe bioavailability.

Main conclusions: S-Fe $AUC_{0\text{-}6h}$ following oral administration of 100 mg Fe is a valid measure of Fe absorption. Dietary modifications of meals with low Fe bioavailability can markedly improve Fe absorption, especially when adding meat which also contributes with highly absorbable heme Fe. Depending on choice of Fe_{elem} in fortification programs effectiveness can differ. Further, if the diet has a low Fe bioavailability, it is difficult to achieve good effects on Fe status by using Fe fortification as the only measure. Thus, the overall conclusion of this thesis is that the best course of action for interventions designed to improve Fe status, firstly must be to ensure an adequate dietary Fe bioavailability, and secondly to use a Fe fortificant with high bioavailability.

Key words: Iron absorption; Serum iron: Relative bioavailability: Elemental iron; Iron bioavailability; Iron fortification; Dietary modification; Developing countries

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