Benefits and Harms of Iron Supplementation in Iron-Deficient and Iron-Sufficient Children

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Introduction

Iron supplements are often recommended for young children since they have high iron requirements. It is important to prevent iron deficiency in young infants, which is associated to poor neurodevelopment. However, in contrast to most other nutrients, excess iron cannot be excreted by the human body and it has recently been suggested that excessive iron supplementation of infants may have adverse effects on growth [1], risk of infections [2], and even on cognitive development [3]. Thus, recommendations regarding iron intake must not only prevent iron deficiency but must also avoid unnecessary iron supplementation of iron-sufficient infants.

Brain Development

Growth and development of the central nervous system is rapid during the first years of life. Iron is critical for brain development since it is essential for myelination, monoamine synthesis and energy metabolism in neurons and glial cells [4]. Animal studies as well as case-control studies in children have shown a consistent association between iron deficiency anemia (IDA) and poor cognitive and behavioral performance [5]. A meta-analysis showed that iron supplementation of children had a significant but modest positive effect on the mental development index of 1.5–2 points of 100 [6].

One recent study suggests that excessive iron intake can have negative effects on brain development: healthy, Chilean infants were randomized to receive fortified formula with a high (12 mg/l) or low (2.3 mg/l) iron content from 6 to 12 months of age [3]. The high-iron group had lower scores on cognitive test scores at 10 years of age. These results need to be verified.
Growth

Most iron supplementation studies in children show no overall effect of iron on growth although a few studies in iron-deficient infants have shown a positive effect and some recent studies have suggested that iron supplements given to iron-sufficient children may have a negative effect on growth [7].

Four studies to date have shown a negative effect of iron supplements on the growth of young children. In contrast to other studies, these have stratified the children based on initial iron status. The mechanism may be interaction with zinc absorption/metabolism, decreased dietary intake due to gastrointestinal side effects of iron supplements or an increased susceptibility to gastroenteritis.

Infections

Iron supplements have been suggested to increase the risk of infections since iron is an essential nutrient for most pathogens. In 2003, a large randomized controlled trial of iron supplementation in Pemba, Zanzibar, had to be terminated due to serious adverse effects [2]. In the iron groups, there was a 15% increased risk of death and an 11% increased risk of hospital admission. A sub-study suggested that the risk of serious adverse events was higher in infants who were initially iron replete. Studies in non-malarious regions have not shown any similar adverse effects.

Conclusions

Iron supplements are beneficial in iron-deficient children but there seems to be a risk of adverse effects in iron-replete infants.

General iron supplementation should not be discouraged in areas with a high prevalence of iron deficiency, with the exception of malarious areas. However, in populations with a low prevalence of iron deficiency, general supplementation should be avoided. Manufacturers of iron-fortified foods for children should probably avoid very high doses of iron fortification. In malarious regions, general iron supplementation should be avoided. In those regions, a cautious supplementation approach needs to be adopted, based either on screening or a combination of iron supplements and infection control measures.

More studies are urgently needed to better determine the risks and benefits of iron supplementation and iron-fortified foods given to iron-deficient and iron-sufficient children.
References


4 Beard J: Recent evidence from human and animal studies regarding iron status and infant development. J Nutr 2007;137:524S–530S.

