J Obstet Gynecol Ind Vol. 54, No. 5 : September/October 2004 Pg 437-438

Editorial

NEW STRATEGY TO COMBAT ANEMIA

'ron deficiency is the most prevalent single nutritional deficiency, affecting more than 2000 million people, approximately 20% of the world's population, nearly 50% of the individuals with iron deficiency progress to iron-deficiency anemia[1]. Iron deficiency is not only seen in developing countries with widespread social and economic deprivation, but also remains a significant problem in industrialized nations. When women of all ages are considered, iron deficiency remains the most frequently encountered health problem worldwide.

However, the prevalence of iron deficiency in women has decreased over past several decades and this has been variously attributed to several factors like prophalaytic iron, iron supplements, better health care and public health programmes, but above all, in a large measure to iron fortification [2]. Iron fortification is a new and effective strategy to combat iron deficiency, that is steadily but significantly gaining a lot of ground today.

But this is definitely not as easy as it sounds. Iron is the most difficult mineral to add to foods to ensure adequate absorption[3]. The main problem is that the water soluble iron compounds, which are most bioavailable often lead to the development of unacceptable color and flavor changes in the food vehicle. When water soluble compounds are added to cereal flour they often cause rancidity and in home grade salt, they rapidly lead to color formation. Insoluble compounds, such as elemental iron powder on the other hand, do not cause sensory changes but may be so poorly absorbed as to be of little or no nutritional benefit.

The other major difficulty to ensuring adequate absorption is the presence of iron

absorption inhibitors in the fortification vehicle itself, or in the accompanying diet. The main inhibitory compound is phytic acid (myo-inositol 6 –phosphate) which is widely present in cereals, grams and legume seeds[4]. Thus there are two major technical barriers to overcome when developing an iron-fortified food. The first is the selection of any iron compound that causes no sensory changes but is adequately absorbed; the second is to overcome the inhibitory effect of phytic acid and the other food components in iron adsorption. The barriers can be overcome and iron –fortified foods that have demonstrated an improved iron status in the target population include infant formula, infant cereal, sugar and fish sauce. All these foods are iron consumed with an enhancer of iron absorption (asorbic acid/ EDTA) added to overcome absorption inhibitors [5].

Selection of an iron fortification compound

The iron compound selected for food fortification should be the one with the highest relative bioavailability value (RBV) that causes no sensory changes, when added to the food vehicle. The first choice would be a soluble compound, such as ferrous sulphate which dissolves instantaneously and has the highest RBV. A good alternative would be water-insoluble compounds, such as ferrous fumarate which may be as well absorbed as ferrous sulphate because they dissolve completely, but more slowly, in the dilute acid or gastric juice. A further advance would be encapsulated ferrous sulphate or ferrous fumarate which also have excellent potential for overcoming unwantend sensory changes while maintaining high RBV

Counteracting inhibitors of iron-absorption.

There are three common strategies to counteract inhibitors of iron absorption. These are ;

i) The addition of asorbic acid or sodium EDTA, together with the iron compound;

ii) The addition of fortification iron in this form that is protected from combining with dietary inhibitors ie.NaFeEDTA, ferrous bis-glycinate, heme iron;

iii) the degradation or removal of phytic acid.

Ascorbic acid

It is the most widely used enhancer of fortification iron. It can increase by several fold the absorption of all fortification iron compounds and native food iron that dissolves in the gastric juice and enters the common iron native iron pool. Asorbic acid enters mainly in the abdomen and duodenum as both solubilizing liquid and reducing agent. It reduces ferric iron to the ferrous state, thus preserving its solubility as the pH rises in the duodenum [6]. Ascorbic acid has been demonstrated to be effective in decreasing the negative effects of all major inhibitors of iron absorption including calcium and milk protein, phytic acid and soya products[7]. Ascorbic acid increases in a useful way the absorption of many commonly used iron compounds including ferrous sulphate, ferric ammonium citrate, ferrous fumarate and electrolytic iron.

NaFe EDTA

The use of NaFeEDTA for food fortification has several advantages. In the presence of phytic acid, iron is 2 to 3 times better absorbed from NaFeEDTA than from ferrous sulphate; it does not oxidize lipids during the storage of cereal flour and unlike many other soluble iron compounds, it does not cause precipitation of peptides. When added to fish sauce or soya sauce in the absence of phytic acid, NaFe EDTA has an absorption similar to that of ferrous sulphate. Main advantage, however, is that it has been demonstrated several times to be efficacious for food fortification, improving the iron status of target populations consuming

NaFeEDTA fortified fish sauce, curry powder and sugar. It has recently been approved by the joint FAO/WHO expert committee on food additives for Government approved fortification strategies[8].

Ferrous bisglycinate

This is a well absorbed iron compound which protects against phytic acid. Lyrisse et al (2000) reported that iron absorption was 4 fold better from ferrous bisglycinate fortified whole corn porridge and about 2 fold better from breakfast meals based on corn- flour or wheat flour, than from the equivalent foods with ferrous sulphate[9].

Hemoglobin

Dired RBC have been added to food as a source of bio available iron. Hemoglobin is absorbed intact to the tune of 15-35% depending on the iron status and is thus protected from the inhibitors of Fe absorption. Hb fortified foods have improved the iron status ofinfants and young children in Chile[10].

Phytic acid degradation

It is statistically possible to completely degrade phytic acid enzymatically in cereal and legume based foods to improve the absorption of iron, zinc and calcium. This would seem ideally suited for manufacturing the best complimentary foods in which absorbic acid has been added . Decreasing the phytic acid in the flour from 1g/100g to 100mgm/100gm increased absorption 2 fold, whereas zero-phytic acid increased absorption 5 fold Commercial phytases can completely degrade phytic acid in 1 to 2 hrs when added to an acqueous slurry of cereal held at the optimum pH and temperature for phytase activity[11]. Traditional food processes such as soaking and germination, can also substantially degrade phytic acid.

Conclusion

This recent strategy of iron fortification of widely used common food article like cereal flour, salt and soya sauce, can perhaps go a long way to combat the problem of iron deficiency in a significant way in the population at large.

References

1. Viferi FE. A new concept in the control of iron-deficiency. *Biomed Environ Sci1998:11:46-60.*
2. Scholl TO, Hediger ML. Anaemia and iron deficiency anaemia: compilation of data on pregnancy outcome. *Am J Clin Nutr 1994;59:482-501.*
3. Hurell RF. The Mineral fortification of foods. 54-99. *Surray. UK, Letherhead publishing 1999;p.54-99.*
4. Reddy NR, Sathe SK, Salunkhe DK. Phytate in legumes and cereals. *Adv Food Res 1982;28:1-92.*
5. Walter T,Pizarro F, Velozo L. Effectiveness of iron-fortified cereal in prevention of iron-deficiency anemia. *Paediatrics 1993;91:976-82.*
6. Conrad ME, Schade SC. Ascorbic acid chelates in iron absorption, a role for Hydrochloric acid and bile. *Gastroenterology 1968; 55:35-45.*
7. Davidson L, Morris A, Hurell RF. Influence of ascorbic acid in iron absorption. *Am J Cln Nutri 1998;67:873-7.*
8. Hurrell RF. Preventing iron-deficiency through food fortification. *Nutr Rev 1997; 56:210-22.*
9. Layrisse M, Gracia-Casal MN, Solano L et al: Iron bioavailability in humans from breakfast enriched with iron bioglycine. *J Nutr 2000; 130:2195-9.*
10. Herframpf FE, Olivares M,Pizarro F et al: Haemoglobin fortified cereal: a source of avaible iron in breast fed infants. *Eur J Clin Nutr 1990; 44:793-8.*
11. Galam P, Cherouvrier F,Hurrell RF et al. Iron bio availability from infant cereals by infants: the effect of dephytinization. *Am J Cln Nutr 1997; 65:916-20.*

M. J. Jassawalla