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Pharmacy Column

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Should vitamin C routinely be given with oral iron supplements?

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Iron is an extremely important mineral that is critical for the function of all cells. Importantly, it is a component of hemoglobin which helps red blood cells deliver oxygen throughout the body.

When a person is deficient in iron, these functions can be disrupted. Iron deficiency is the most common nutritional cause of anemia in humans. There are many symptoms of iron deficiency including decreased exercise capacity, lethargy and dyspnea which can increase risk of falls.

The pharmacology and kinetics of iron have been extensively studied and are well understood and documented. The human body conserves its iron stores to a remarkable degree and men normally lose only 10% of their stores annually. Women experience additional loss due to menstruation, pregnancy and lactation. Other causes of iron loss include use of medications that may cause GI bleeding such as anti-inflammatory drugs and GI disease associated with bleeding.[1]

This column will focus on a very specific aspect of iron replacement therapy which is the question *"Should vitamin C routinely be given with oral iron supplements?"* I recall seeing this combination more commonly a few decades ago compared to today, yet I do still see the combination prescribed today.

The absorption of orally administered iron is complex. Many different factors influence its absorption including the form of iron administered, the dosage, a person's iron stores, the rate at which they are producing red blood cells and their diet. Depending on these factors, the bioavailability of iron can range from 15 to 50%.

The diagnosis of iron deficiency anemia is relatively straightforward. If a state of deficiency exists, iron supplementation and replacement may be necessary. This can be addressed by diet or commonly treated by the administration of oral iron, of which there are a number of compounds and dosage forms available.

Iron in the ferrous form appears to be most readily absorbed. Oral dosage forms include ferrous sulfate, gluconate, fumarate, succinate, aspartate and other ferrous salts. While absorption of iron can take place along the entire gastro-intestinal tract, absorption is greatest in the duodenum and the proximal jejunum. Some iron products are designed to provide delayed release of iron from the dosage form into the intestine past the point of greatest absorption thus reducing iron absorption from those products.

Iron is best absorbed when taken on an empty stomach with a full 8-ounce glass of water or orange juice. If the patient experiences upset stomach, iron can be given with food or immediately after meals.[2] When taken with meals iron absorption decreases to 40%.[3]

Some components of diet directly affect iron bioavailability. Absorption of oral iron is inhibited by phytates (found in cereals and vegetables), polyphenols (found in vegetables, fruits, some cereals and legumes, tea, coffee, and wine). Calcium and proteins may also inhibit iron absorption. Tea can reduce iron absorption by 90%.[3]

Antacids or calcium supplements or aluminum-containing phosphate binders may decrease iron absorption and should not be taken at the same time as iron. It is best to space doses of these products 1–2 h apart from iron, to get the full benefit from each medicine or dietary supplement.[2,4]

Numerous studies have demonstrated that dietary vitamin C can significantly increase the absorption of dietary iron.[5] These findings suggest that the ability of ascorbic acid to chemically reduce iron to the more soluble ferrous state and thus prevent the formation of less-

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soluble ferric compounds is probably an important mechanism of action for the absorption-promoting effect of ascorbic acid.[5]

It has also been found that oral administration of supplemental ascorbic acid may enhance iron absorption.[3] In one study, taking 100 mg of vitamin C with a meal increased iron absorption by 67%.[6]

It was this finding that promoted the belief that oral iron therapy would be improved with routine concurrent administration of vitamin C. This may be true to a point but is not without a possible down side. The iconic text Goodman and Gilman's: Pharmacologic Basis of Therapeutics states that ≥200 mg of ascorbic acid increases the absorption of medicinal iron by at least 30%. However, this increased uptake is associated with an increase in the incidence of side effects. These side effects include epigastric discomfort, nausea, diarrhea and constipation.[3]

The American Hospital Formulary Service states that concurrent administration of more than 200 mg of ascorbic acid per 30 mg of elemental iron increases absorption of iron from the GI tract. However, it adds the caveat that most individuals are able to absorb orally ingested iron adequately without concurrent administration of ascorbic acid. They also state that preparations containing both iron and ascorbic acid may not contain sufficient quantities of ascorbic acid to substantially affect iron absorption.[4] And, these dosage forms may be considerably more expensive than the administration of iron and vitamin C separately.

In spite of the understanding that Vitamin C can increase iron absorption, firm and clear recommendations to routinely supplement iron therapy with Vitamin C are lacking.

Now let's get back to the question, *"Should vitamin C routinely be given with oral iron supplements?* Like so many of the topics that I have covered in this column, my answer to this question is, "It depends." There is not a clear mandate to do so. However, there is scientific evidence that iron absorption is increased by the concurrent administration of vitamin C, either through foods such as orange juice or supplements such as vitamin C tablets. Like so many other aspects of medication use in the elderly it depends on risk v. benefit. It also depends on how concerned we are with polypharmacy. Routinely adding another medication, even something as innocuous as vitamin C, may increase the risk of side effects, increase expense, contribute to patient inconvenience and poor adherence to therapy and add to the time devoted to medication ordering and administration.

Since iron is generally well-absorbed and iron deficiency anemia generally responds to iron supplementation rather quickly I suggest that routinely adding yet another medication to what might already be a complicated medication regimen might not be necessary. Rather, I suggest to first make certain that the iron supplement is being administered correctly for optimal absorption to occur, which includes administering it at the right time, not giving it with dietary selections that compete with iron absorption and avoiding drug-drug interactions that decrease iron absorption. If the response to oral iron is inadequate after 3–4 weeks the diagnosis of iron deficiency anemia must be reconsidered.[1]

References

1. Kaushansky K, Kipps TJ. Chapter 41. Hematopoetic agents: growth factors, minerals, and vitamins. IN In Goodman and Gillman's: The Pharmacological Basis of Therapeutics. 13th ed. 2018.
2. Mayo Clinic, Drugs & Supplements. Iron Supplements (Oral route, parenteral route) March1, 2019. Available at: https://www.mayoclinic.org/drugs-supplements/iron-supplement-oral-route-parenteral-route/proper-use/drg-20070148. Accessed 5 April 2019.
3. Lopez AL, Cacoub P, Macdougall IC, Peyrin-Biroulet L. Iron deficiency anemia. *Lancet*. 2016;387:907–916.
4. AHFS Drug Information. *20.04.04 Iron Preparations*. MD: American Hospital Formulary Service Bethesda; 2018.
5. Hallberg L, Hulthen. Prediction of dietary iron absorption: an algorithm for calculating absorption and bioavailability of dietary iron. *Am J Clin Nutr*. 2000;71:1147–1160.
6. Tan V. How to increase the absorption of iron from foods. Health Line 6/3/17. Available at: https://www.healthline.com/nutrition/increase-iron-absorption. Accessed 5 April 2019.