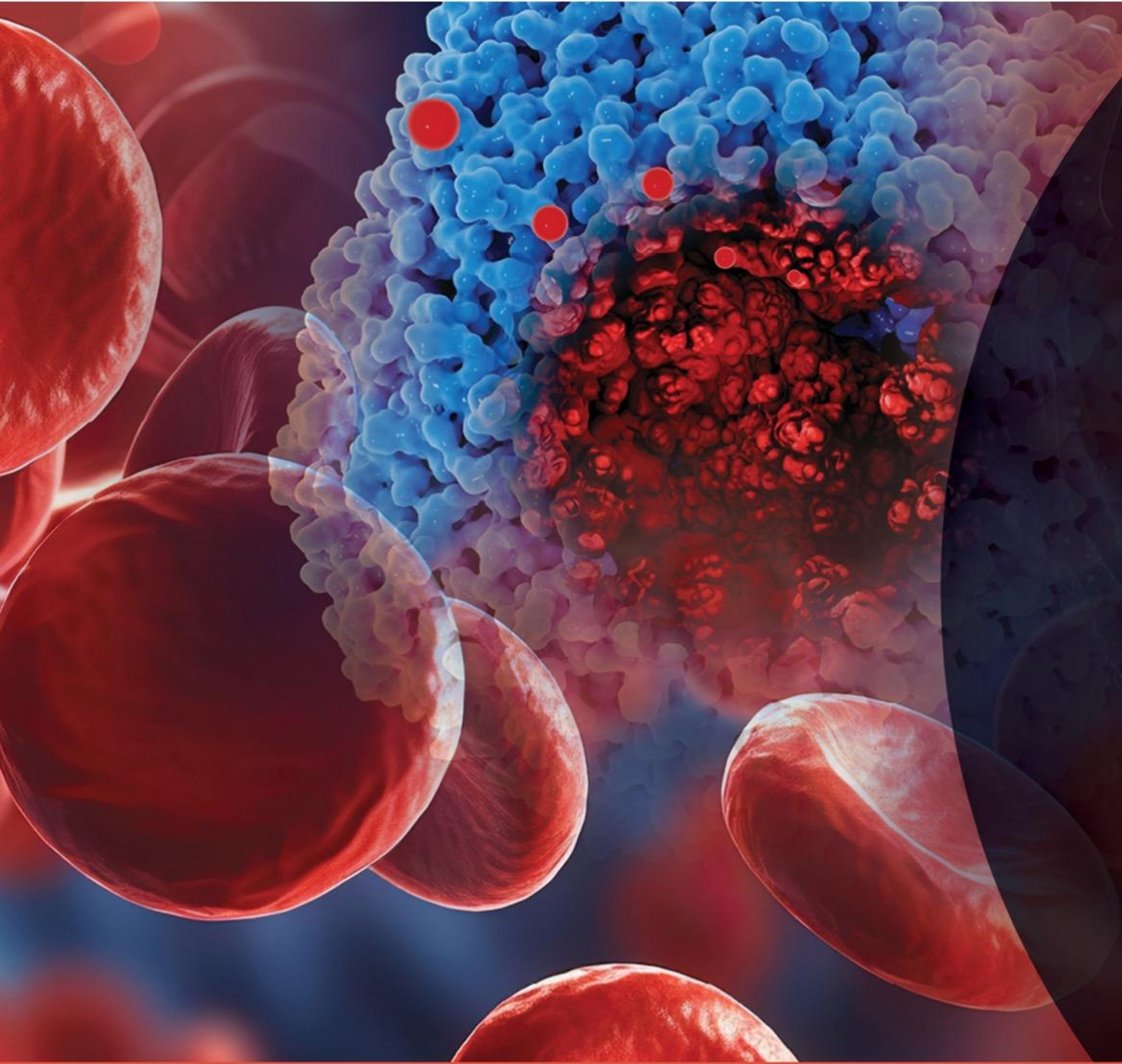

Albion® Minerals

designs for health® Australia

The Learning COLLECTIVE

Iron Absorption Unlocked

Presented by:
Rodney Benjamin
Director,
Nutrition Science,
Albion Laboratories

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Albion Minerals®
The Power of Winerals™

Presenter | Rodney Benjamin

Rodney Benjamin is a highly respected leader in the field of nutrition science, holding degrees in both Chemistry and Business Administration. With over 25 years of hands-on experience in the dietary supplement industry, Rodney has developed deep expertise in manufacturing, regulatory compliance, and quality control.

As the Director of Nutrition Science at Albion Laboratories Inc., a subsidiary of Balchem Corporation, Rodney plays a pivotal role in advancing the science and application of chelated minerals and other specialty ingredients that support optimal human health. His work is grounded in a commitment to evidence-based nutrition, quality assurance, and innovation, making him a trusted partner for practitioners who prioritise both efficacy and safety in natural health solutions.

His collaborative work with health professionals, researchers, and industry partners reflects a passion for translating scientific discovery into real-world health benefits. Rodney's dedication ensures that natural health practitioners have access to high-quality, innovative, and reliable nutritional products that support holistic wellbeing.

Co-host | Lea McIntyre

Lea McIntyre is Head of Marketing at Designs for Health Australia

She has 20 years experience as a qualified naturopath, herbalist and nutritionist.
In her clinical practice, she has a special interest in paediatric health and gut health and the relationship between inflammation and neurological conditions.

Lea has developed a strong relationship with the Designs for Health practitioner community. She will moderate the Q&A discussion with Rodney Benjamin in this webinar and engage our live Designs for Health practitioner community to bring insight and practical clinical pearls for all.

Hard to solve Iron cases - additional considerations for iron absorption and bioavailability

Albion® Minerals

A Product of Balchem Corporation

Ferrochel®

Ferrous Bisglycinate Chelate

Contents

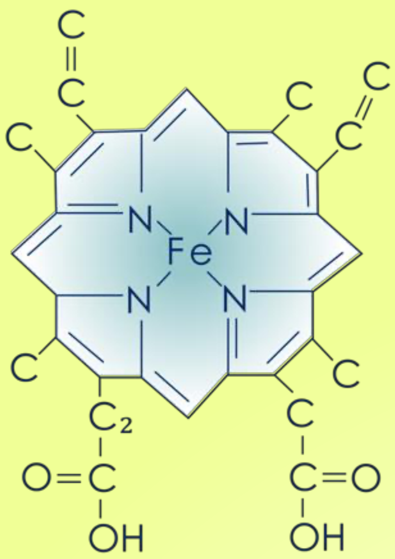
Scientific Snapshot
Iron

What Is Iron?

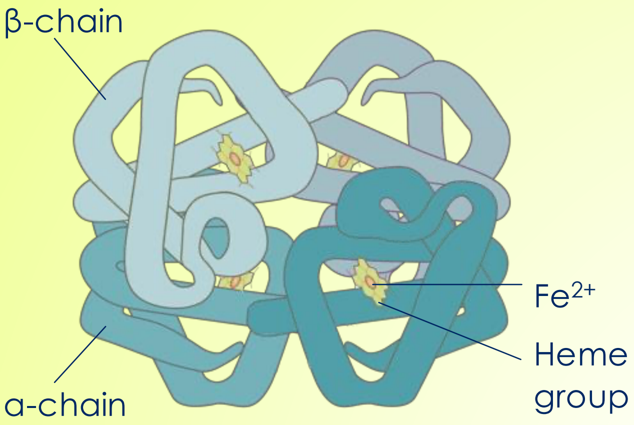
Iron is an essential mineral that plays an **important role in metabolizing oxygen**.

Iron plays two key roles:

- **Structural**: Iron is a key component of proteins such as hemoglobin and myoglobin
- **Functional**: Iron has multiple oxidation states (-2 to +6) which allow it to bind to multiple atoms (e.g., oxygen, nitrogen, sulfur)



Hemoglobin



Fun Fact: Iron containing heme proteins are what give red meat its characteristic color.

Source: Food and Nutrition Board, Institute of Medicine, 2001; https://ods.od.nih.gov/factsheets/Iron-HealthProfessional/
Image Hemoglobin: © Encyclopaedia Britannica, Inc.

What Does Iron **Do for Me?**

Maintains healthy red blood cells

Supports immune health

Supports physical performance

Maintains healthy cognitive function

Supports healthy energy metabolism

Essential for mom and baby to help support a healthy pregnancy

Source: Food and Nutrition Board, Institute of Medicine, 2001; Office of Dietary Supplements; https://ods.od.nih.gov/factsheets/Iron-HealthProfessional/

How Much Iron Do We Need?

Recommended Dietary Intake
RDI for iron in Australia and New Zealand

Age Group	Males	Females	Pregnancy	Lactation
0-6 months	0.2 mg*	0.2 mg*	--	--
7-12 months	11 mg	11 mg	--	--
1-3 years	9 mg	9 mg	--	--
4-8 years	10 mg	10 mg	--	--
9-13 years	8 mg	8 mg	--	--
14-18 years	11 mg	15 mg	27 mg	10 mg
19-50 years	8 mg	18 mg	27 mg	9 mg
51+ years	8 mg	8 mg	--	--

Recommended Daily Intake
EAR for iron in Australia and New Zealand

Age Group	Males	Females	Pregnancy	Lactation
0-6 months	0.2 mg*	0.2 mg*	--	--
7-12 months	7 mg	7 mg	--	--
1-3 years	4 mg	4 mg	--	--
4-8 years	4 mg	4 mg	--	--
9-13 years	6 mg	6 mg	--	--
14-18 years	8 mg	8 mg	23 mg	7 mg
19-50 years	6 mg	8 mg	22 mg	6.5 mg
51+ years	6 mg	5 mg	--	--

Source: Eatforhealth.gov.au Nutrient Reference Values for Australia and New Zealand
https://www.eatforhealth.gov.au/nutrient-reference-values/nutrients/iron

Rationale

Adults

- The EARs for adults were set by modelling the components of iron requirements, **estimating the requirements for absorbed iron at the 50th centile w**ith use of an upper limit of 18% iron absorption, and rounding (FNB:IOM 2001).

- The RDI was set by modelling the components of iron requirements, **estimating the requirement for absorbed iron at the 97.5th centile,** with use of an upper limit of 18% iron absorption and rounding.

Women

- The large difference between the EAR and the RDI in women aged from 19-50 years reflects **high variability in needs related to variability in menstrual losses.** In setting the EARs and RDIs for women, it was assumed that women over 50 years do not menstruate.

Vegetarian Infants

- Absorption is about 18% from a mixed western diet including animal foods and about 10% from a vegetarian diet; so vegetarian infants will need higher intakes about 80% higher.

Source: Eatforhealth.gov.au Nutrient Reference Values for Australia and New Zealand
https://www.eatforhealth.gov.au/nutrient-reference-values/nutrients/iron

Where Can We Find **Iron in Our Diet?**

Food	**mg/Serving**	**% DV**
Fortified breakfast cereals	18	100%
Oysters, 3 oz	8	44%
White beans, 1 cup	8	44%
Dark Chocolate, 45-69% cacao, 3 oz	7	39%
Beef liver, 3 oz	5	28%
Spinach, ½ cup	3	17%
Tofu, firm, ½ cup	3	17%
Chickpeas, ½ cup	2	11%
Beef, braised bottom round, 3 oz	2	11%
Bread, whole wheat, 1 slice	2	11%

USFDA Daily Value (Adults & Children Age ≥ 4y) **= 18 mg** = Aus/NZ RDI 19-50 yr Females

Source: Office of Dietary Supplements; https://ods.od.nih.gov/factsheets/Calcium-HealthProfessioal/

In order to get **100% DV of iron (18 mg)**, you could eat:

6 servings of **spinach** (3 cups)

9 servings of **chickpeas** (4.5 cups)

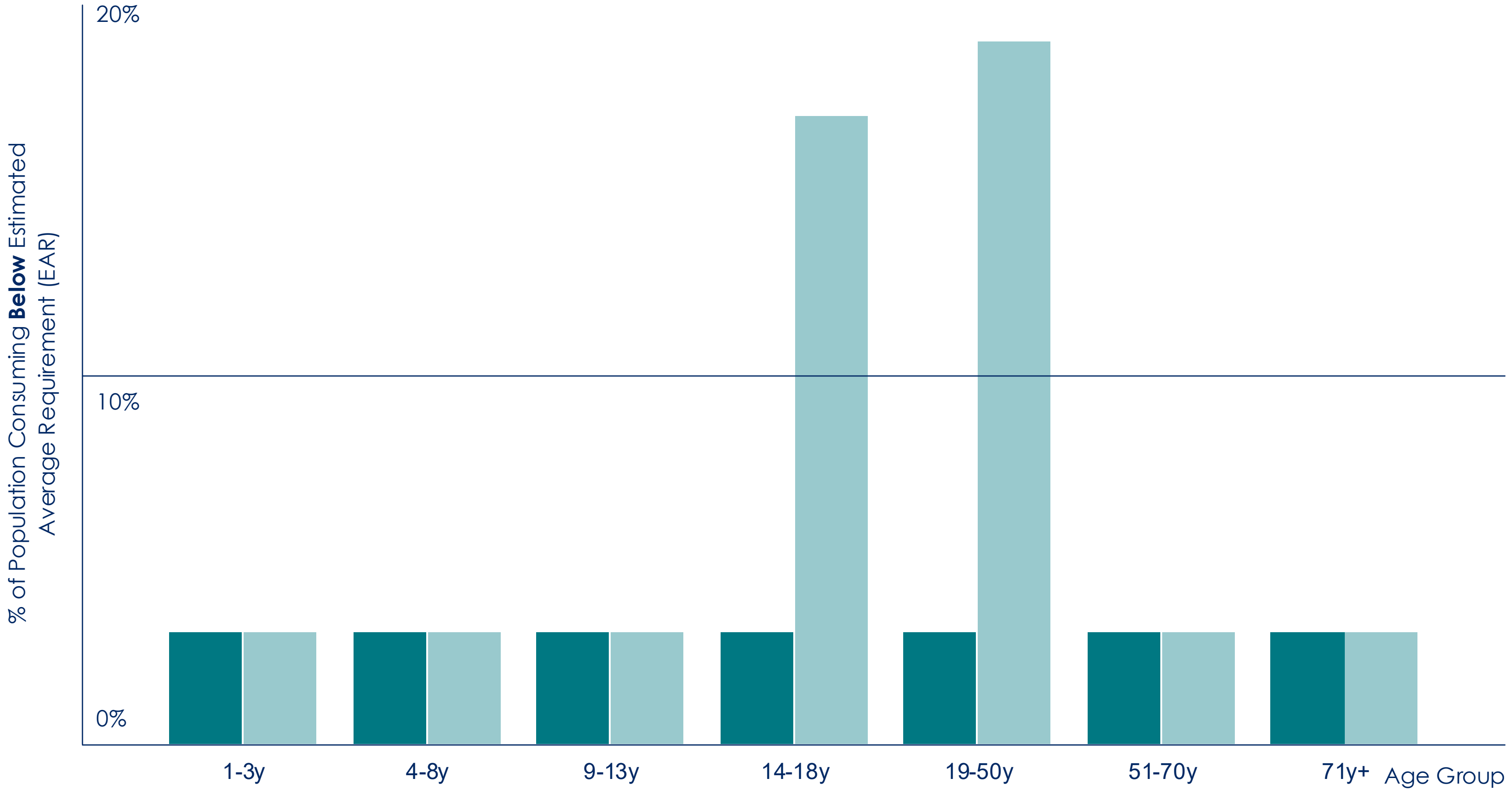
9 servings of **beef** (27 oz)

Are We Getting **Enough Iron?**

Adolescent and adult females have the **highest prevalence of dietary iron inadequacy** in the United States

Females

Males



Usual nutrient intake from food & beverages; n=15,210

Source: https://www.ars.usda.gov/ARSUserFiles/80400530/pdf/usual/Usual_Intake_gender_WWEIA_2015_2018.pdf

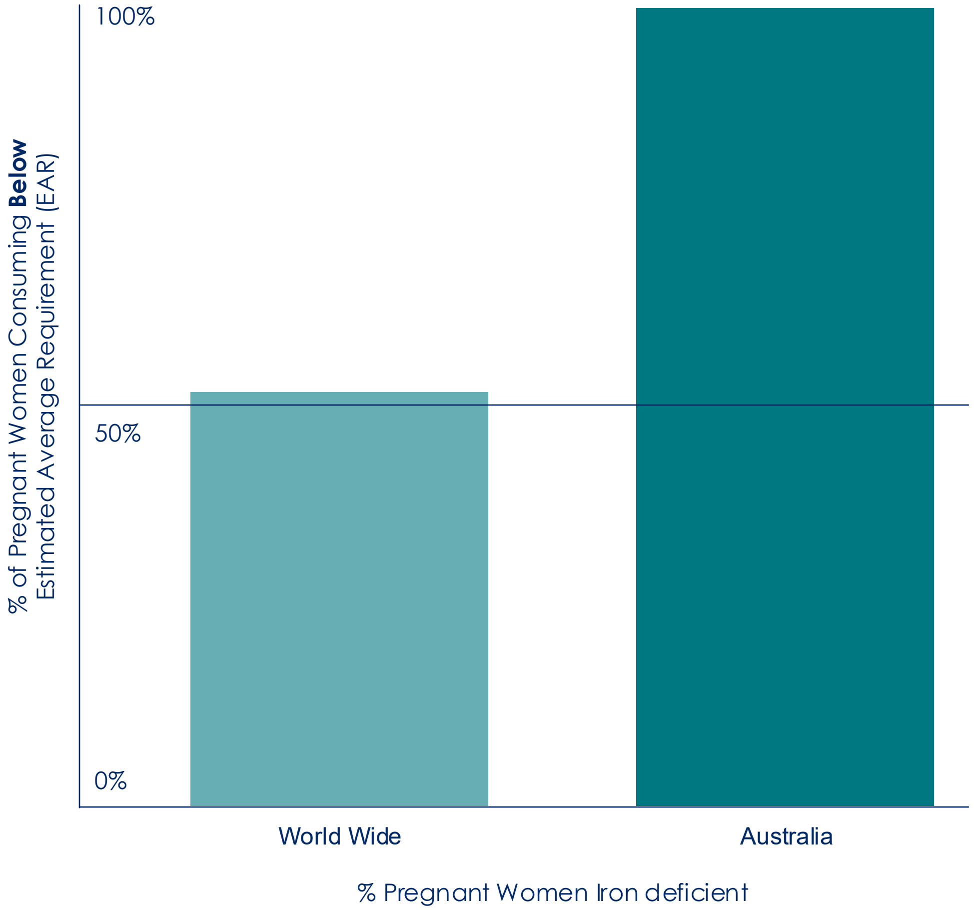
Iron Inadequacy Is Common Among **Pregnant Women World-Wide**

52%

Iron deficiency is a global health concern, estimated to affect up to 52% of pregnant women worldwide (Abu-Ouf & Jan, 2015)

100% and in Australia

In the BABY1000 Study (n=171) nutrient intakes were compared to Australian Nutrient Reference Values, no participants met the Estimated Average Requirement for iron



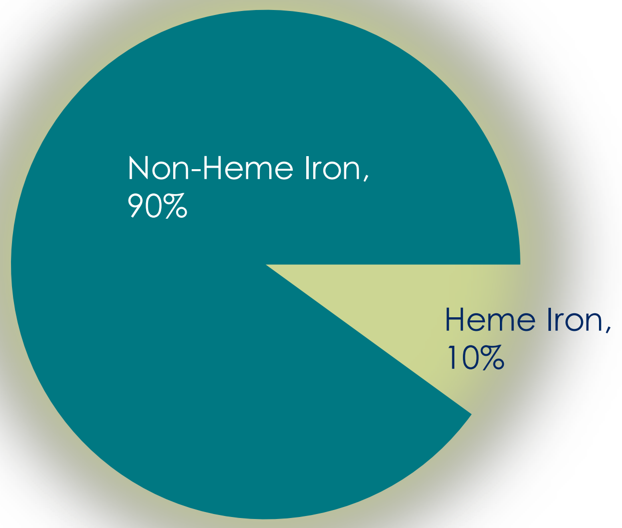
Source: Maneschi et al.,Food Sci Nutr. 2023;11:4113–4123

Heme vs Non-Heme Iron

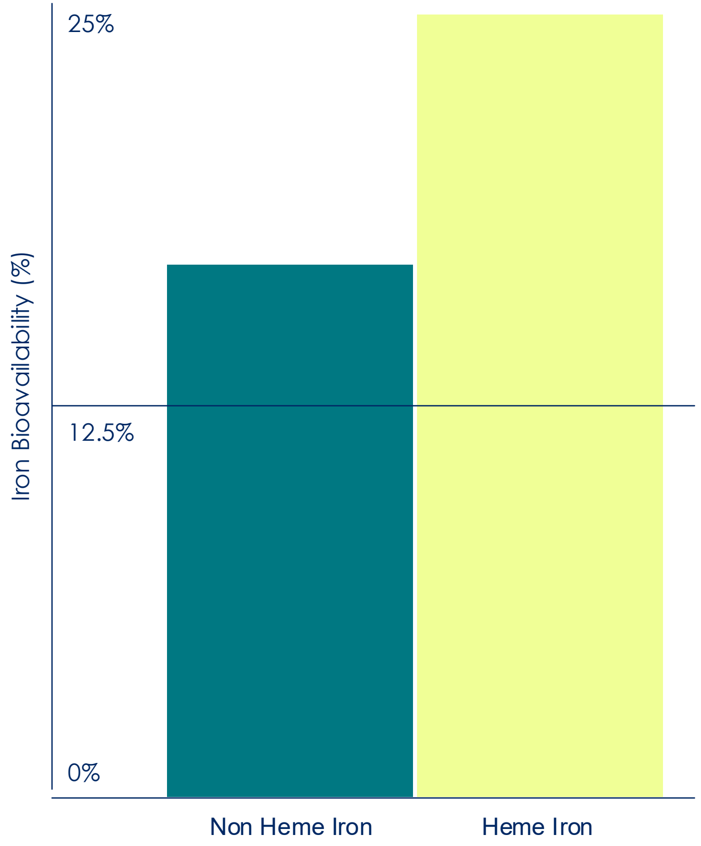
What's the Difference?

Dietary iron comes in two forms:

- **Heme iron**: animal sources (e.g., beef, poultry, seafood)
- **Non-heme iron**: whole grains, nuts, seeds, legumes, leafy greens, fortified breakfast cereals



Iron Bioavailability



Heme iron is the body's preferred source because:

- It has **higher bioavailability** than non-heme iron (25% vs 17%)
- Anti-nutrients (e.g., phytates) have less effect on the bioavailability of heme iron

The average Western diet contains just ~10% heme iron.

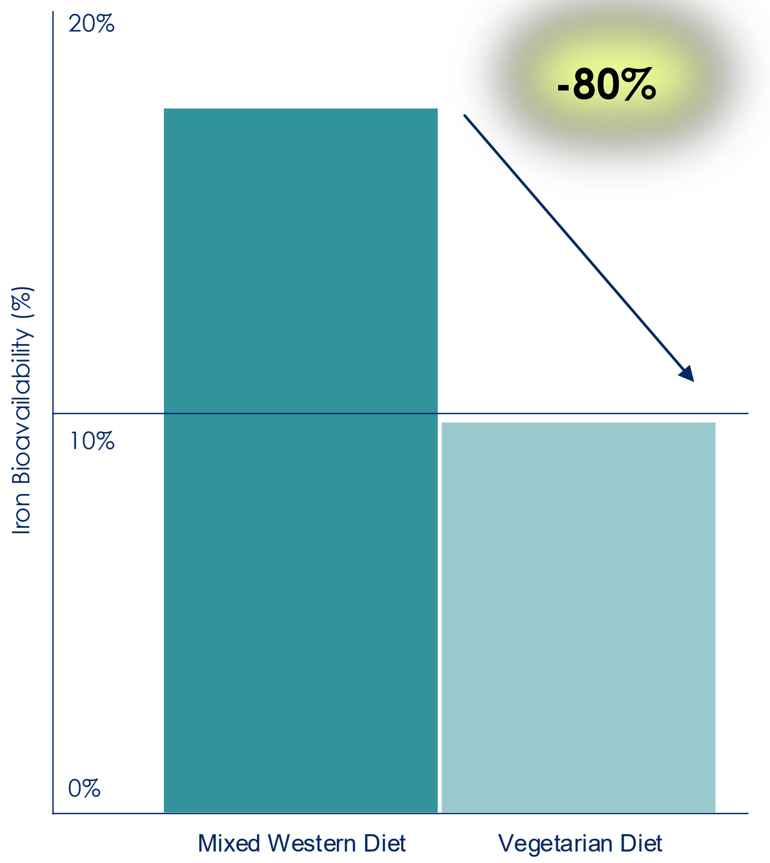
Sources: Office of Dietary Supplements; https://ods.od.nih.gov/factsheets/Iron-HealthProfessional/ | Food and Nutrition Board, Institute of Medicine, 2001

Vegetarians Have Higher Iron Requirements

Vegetarians may consume limited amounts of heme iron, placing them at higher risk of deficiency.

1.8x
higher

	General Population	**Vegetarians**
Adult Males, age 19-50y	8 mg/day	14.4 mg/day
Adult Females, age 19-50y	18 mg/day	32.4 mg/day
Pregnant Females, 19-50y	27 mg/day	48.6 mg/day



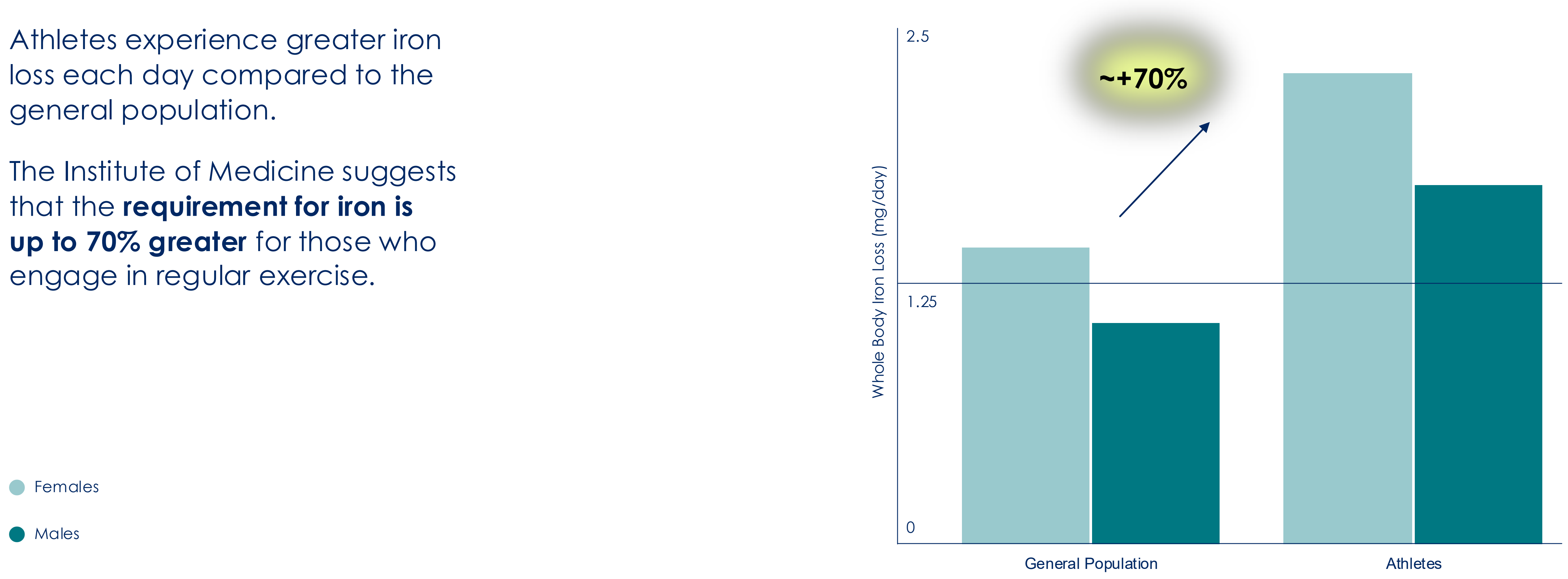
According to the IOM, the **RDA for iron is 1.8x higher for vegetarians**.

Sources: Office of Dietary Supplements; https://ods.od.nih.gov/factsheets/Iron-HealthProfessional/ | Food and Nutrition Board, Institute of Medicine, 2001

Athletes Have an Increased Need for Iron

Athletes experience greater iron loss each day compared to the general population.

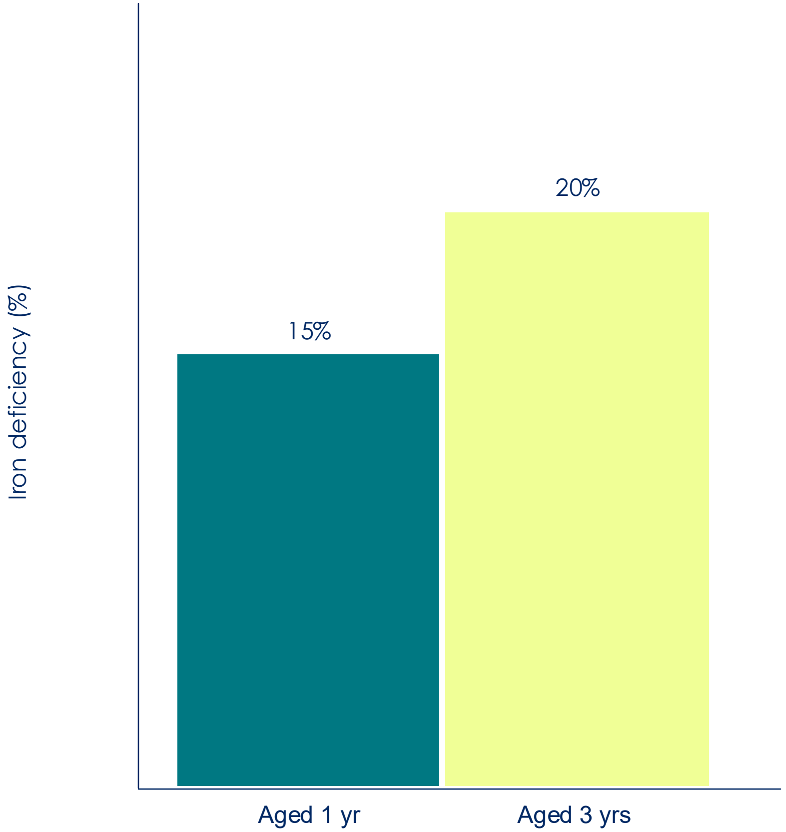
The Institute of Medicine suggests that the **requirement for iron is up to 70% greater** for those who engage in regular exercise.



Sources: Weaver & Rajaram; J Nutr 1992; 782-787 | Food and Nutrition Board, Institute of Medicine, 2001, p352-353; Among males after puberty and menstruating females

Iron Deficiency Is Common Among **Australian Children**

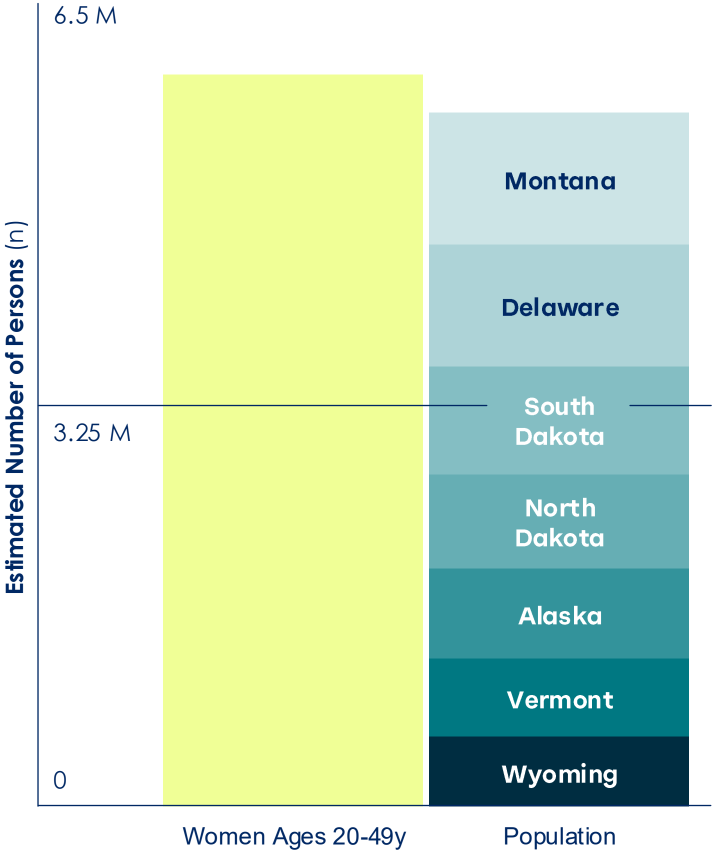
Preliminary finding from ORIGINS (a large study of children in Perth, Western Australia) show a **Prevalence of Iron deficiency in Australian Children of 15%** at aged **1 yr** and **20%** at aged **3 yrs**



Source: Journal of Paediatrics and Child Health, 2025; 0:1–2 https://doi.org/10.1111/jpc.70068
Iron deficiency defined as WHO cut-off ferritin value of <12µg/L

Iron Deficiency Is Common Among **Women of Childbearing Age**

Nearly 1 in 10 (9.6%) women ages 20-49 years in the United States are estimated to have an iron deficiency.



The prevalence of iron deficiency among adult women is **higher than the population of Wyo-ming, Vermont, Alaska, North and South Dakota, Delaware and Montana – COMBINED**.

Source: CDC 2nd Report on Biochemical Indicators of Nutrition; Iron deficiency defined as body iron < 0 mg/kg

Iron Inadequacy Is Recognized by Dietary Guidelines

Dietary component of public health concern: Under consumed nutrients that are associated with health concerns.

Iron is a dietary component of public health concern for specific age/ gender groups:

- Infants & ages 6 through 11
- Adolescent females ages 14-18y
- Women who are pregnant

World Health Organization

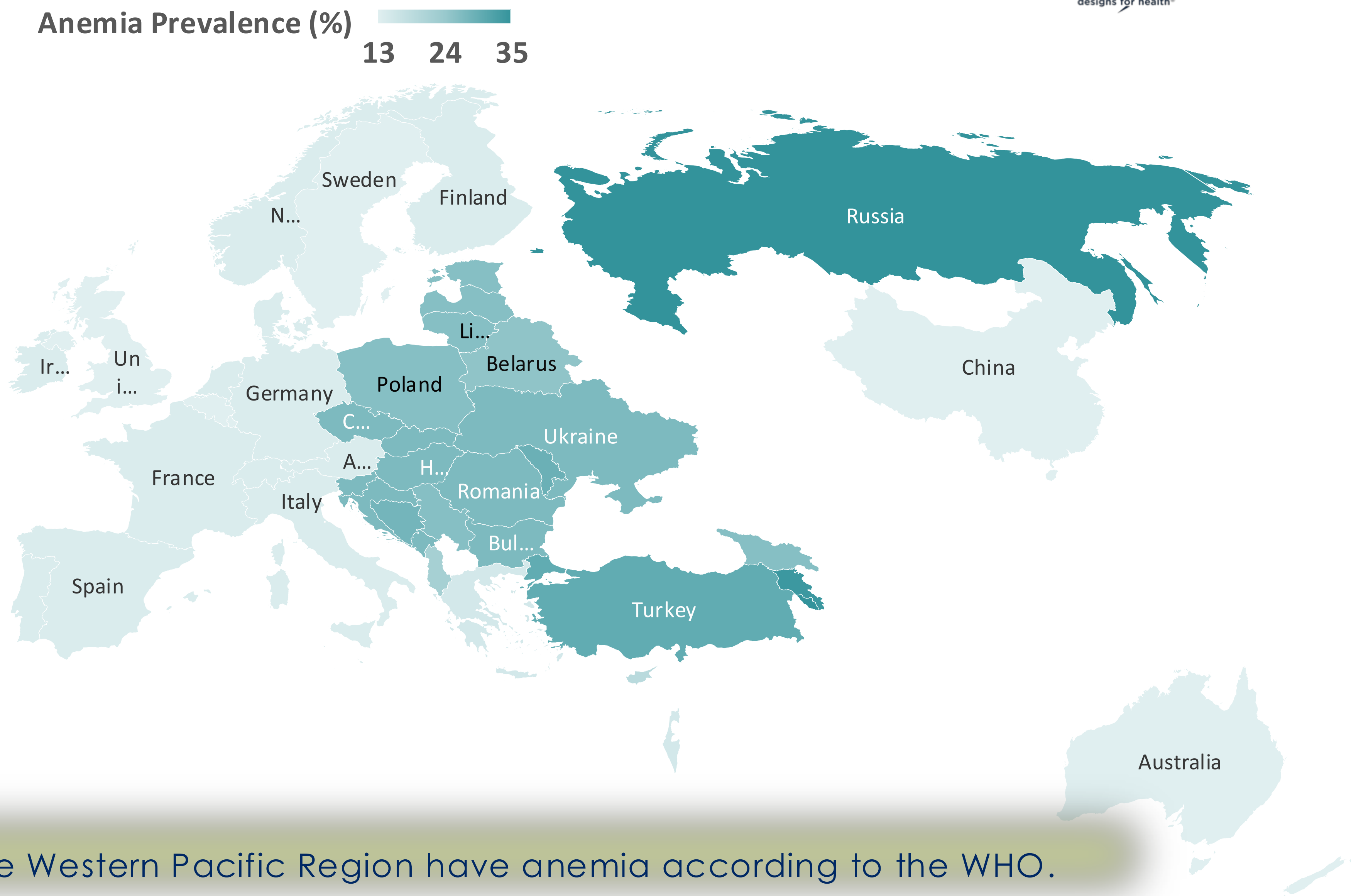
Guideline: Daily iron supplementation in adult women and adolescent girls. Geneva: World Health Organization; 2016.

eatforhealth.gov.au

Sources: Nutrient Reference Values for Australia and New Zealand https://www.eatforhealth.gov.au/nutrient-reference-values/nutrients/iron; 2020-2025 Dietary Guidelines for Americans; https://www.dietaryguidelines.gov/

Nutrient Gaps Iron

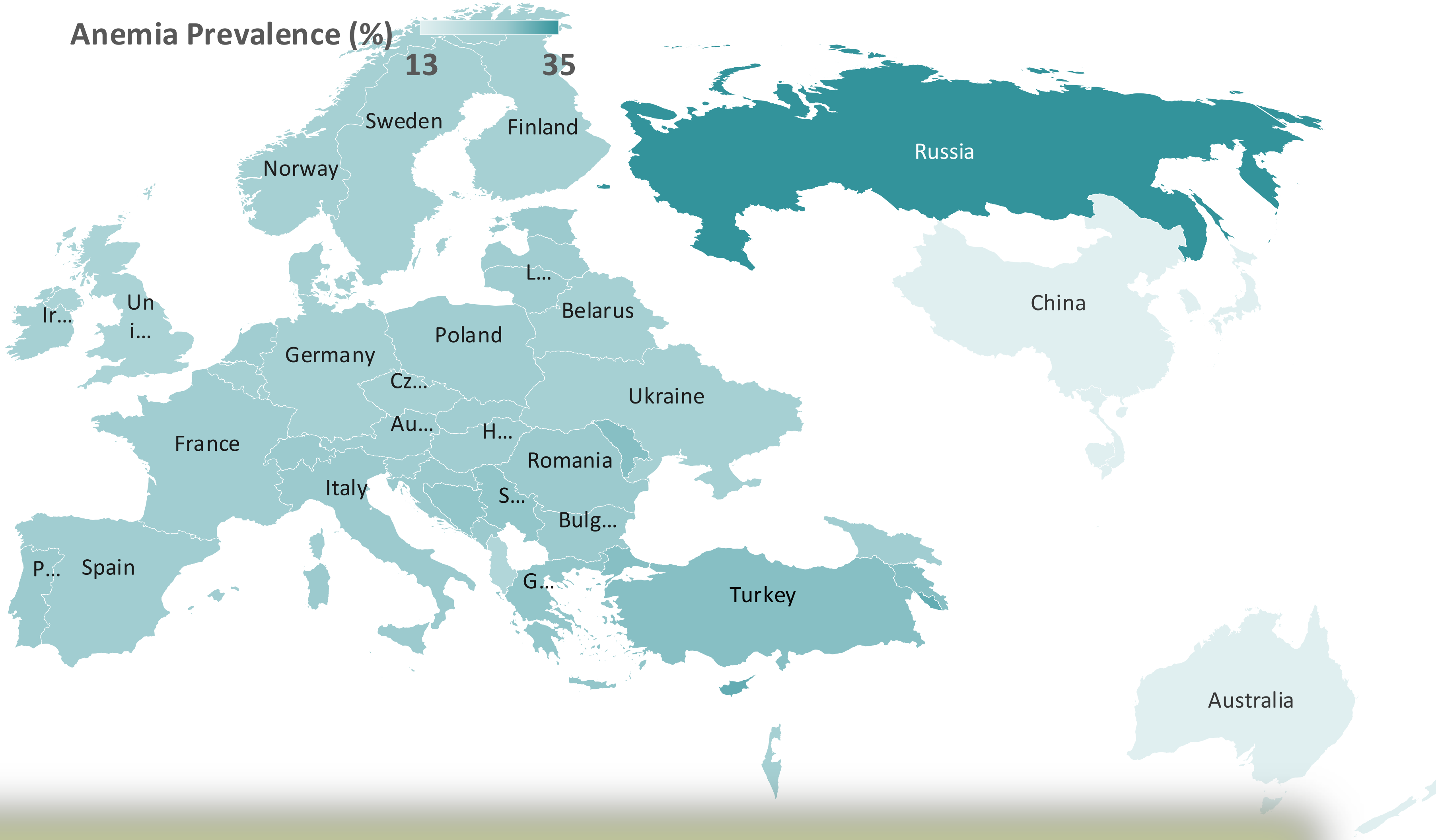
Anemia Prevalence: **Children 6-59 Months**



Over 1 in 5 (21.9%) Children in the Western Pacific Region have anemia according to the WHO.

Source: WHO. The global prevalence of anaemia in 2011. Geneva: World Health Organization, 2015 | Anemia defined as blood hemoglobin < 110g/L

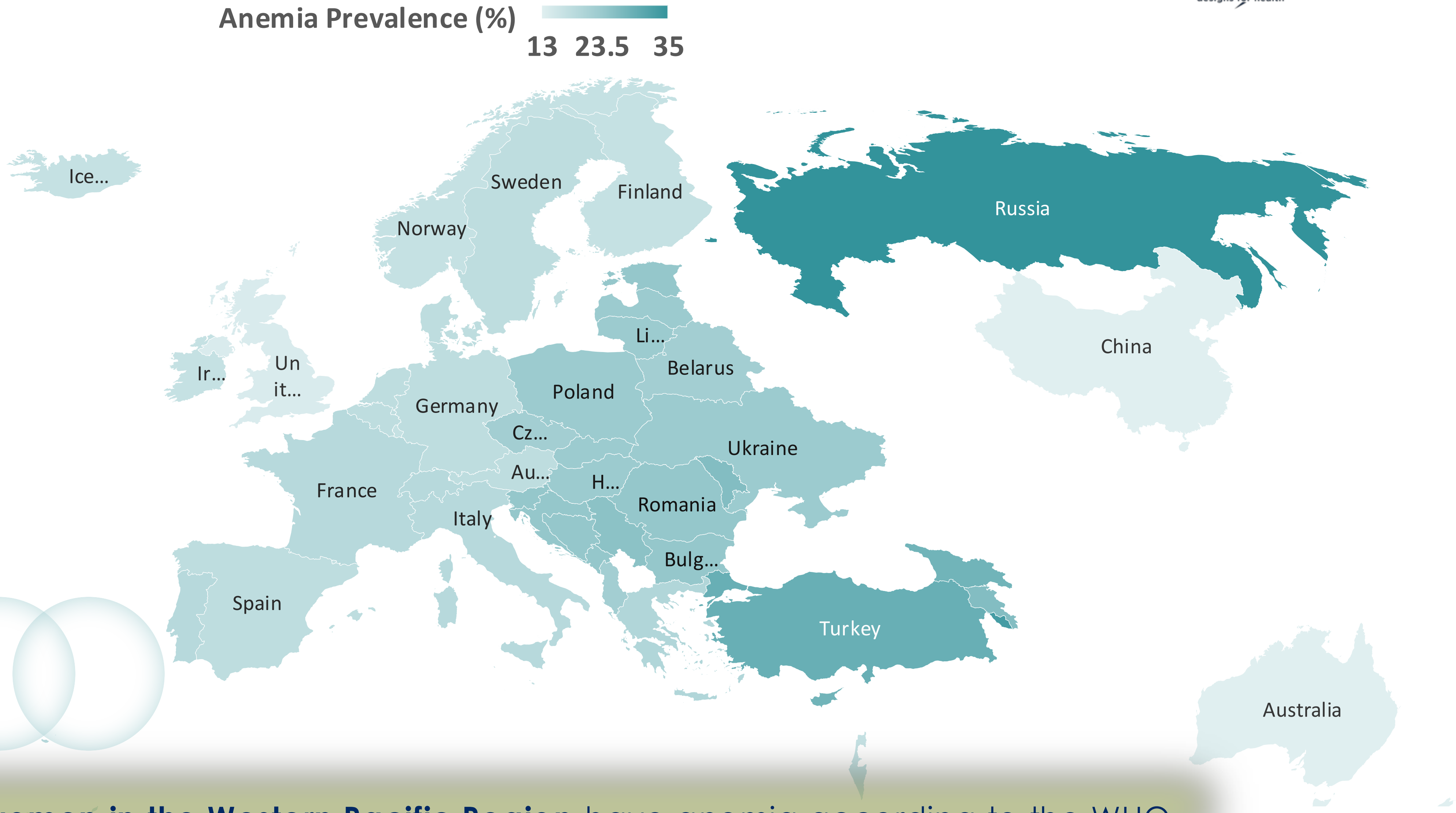
Anemia Prevalence: **Pregnant Women 15-49 Y**



Nearly 1 in 4 (24.3) pregnant women in the Western Pacific Region have anemia according to the WHO.

Source: WHO. The global prevalence of anaemia in 2011. Geneva: World Health Organization, 2015 | Anemia defined as blood hemoglobin < 110g/L

Anemia Prevalence: **Non-Pregnant Women 15-49 Y**



Nearly 1 in 5 (19.8%) women in the Western Pacific Region have anemia according to the WHO.

Source: WHO. The global prevalence of anaemia in 2011. Geneva: World Health Organization, 2015 | Anemia defined as blood hemoglobin < 110g/L

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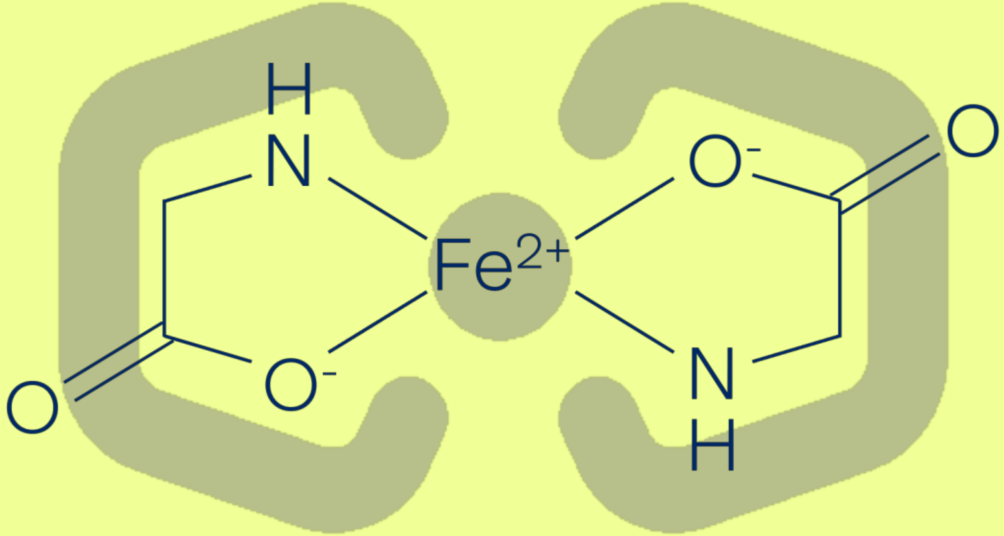
Why Use **Mineral Chelates?**

What Are **Mineral Chelates?**

Chelates are minerals bound to amino acids such as glycine.

Mineral chelates have been shown to reduce the binding of anti-nutrients (e.g., phytates) and are **better absorbed** than their non-chelated counterparts.

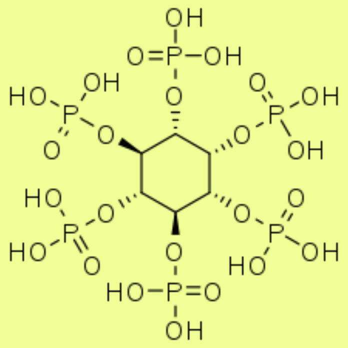
Mineral chelates have better solubility making them well suited for specific applications (e.g., beverages).



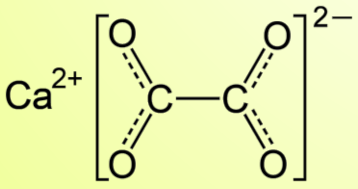
What Are **Anti-Nutrients?**

Anti-nutrients are components of foods that can **limit the absorption of key nutrients** such as calcium, iron, zinc, and magnesium.

Anti-nutrients **include phytic acid and oxylates,** and are commonly **found in many plant-based foods** such as nuts, grains, and seeds.



Phytic Acid

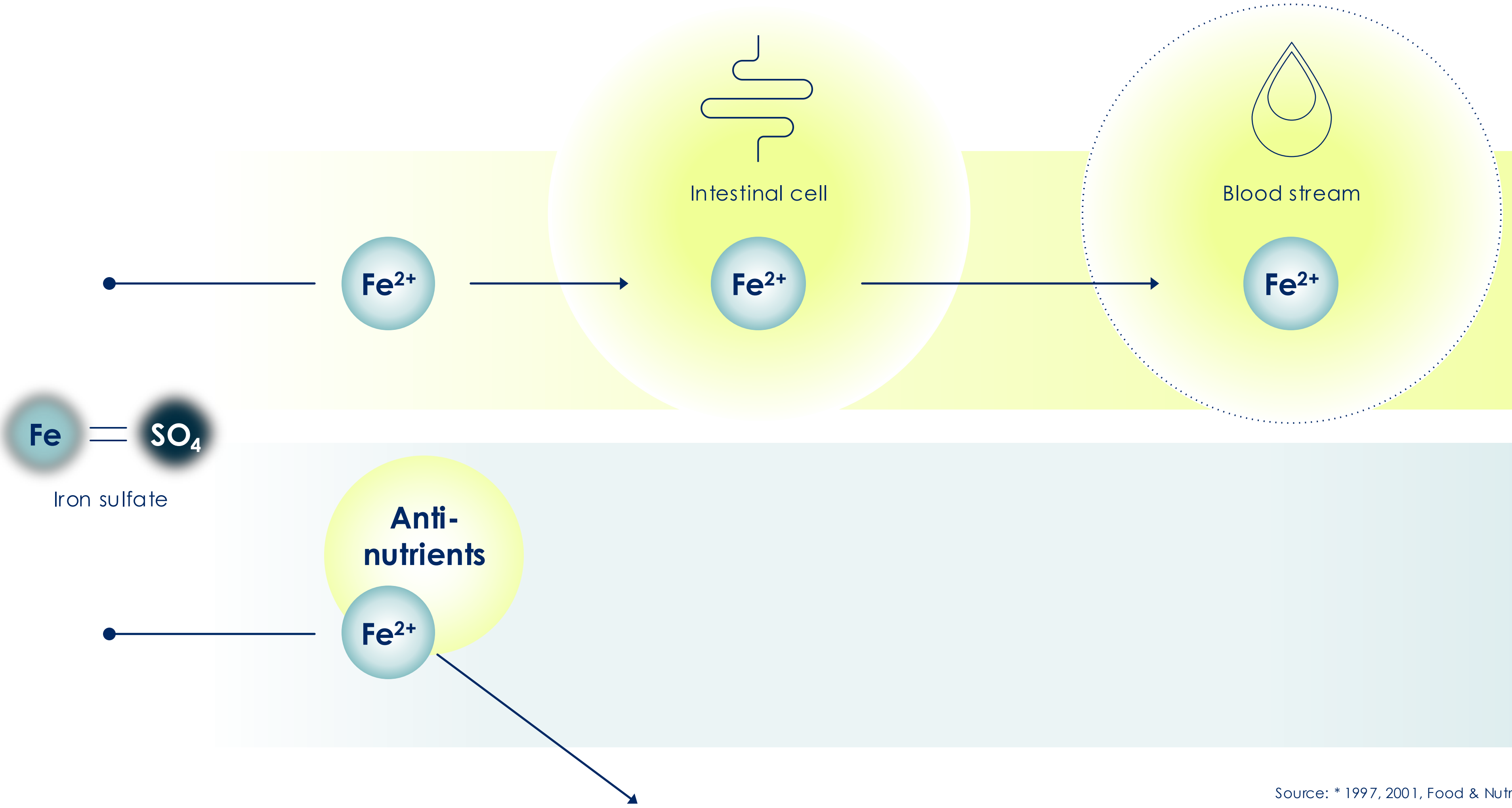


Calcium Oxalate

Food	**Min Phytate Content** (mg/100 g)
Pumpkin seeds	4.30
Tofu	1.46
Almonds	1.35
Soybeans	1.00
Peanuts	0.95
Maize (corn)	0.75
Oatmeal	0.89
Brown Rice	0.84

Sources: Harvard Nutrition Source, https://www.hsph.harvard.edu/nutritionsource/anti-nutrients/ | Holmes RP & Kennedy M., Kidney Int 2000; 57(4): 1662-1667

What Happens to **Inorganic Minerals in the Body?**



Fates of inorganic minerals during digestion:

Form a charged ion and become **absorbed through the conventional pathway**

Attract and bind to anti-nutrients* (e.g, phytate) → **remain unabsorbed and pass through the digestive tract**

Source: * 1997, 2001, Food & Nutrition Board, Institute of Medicine

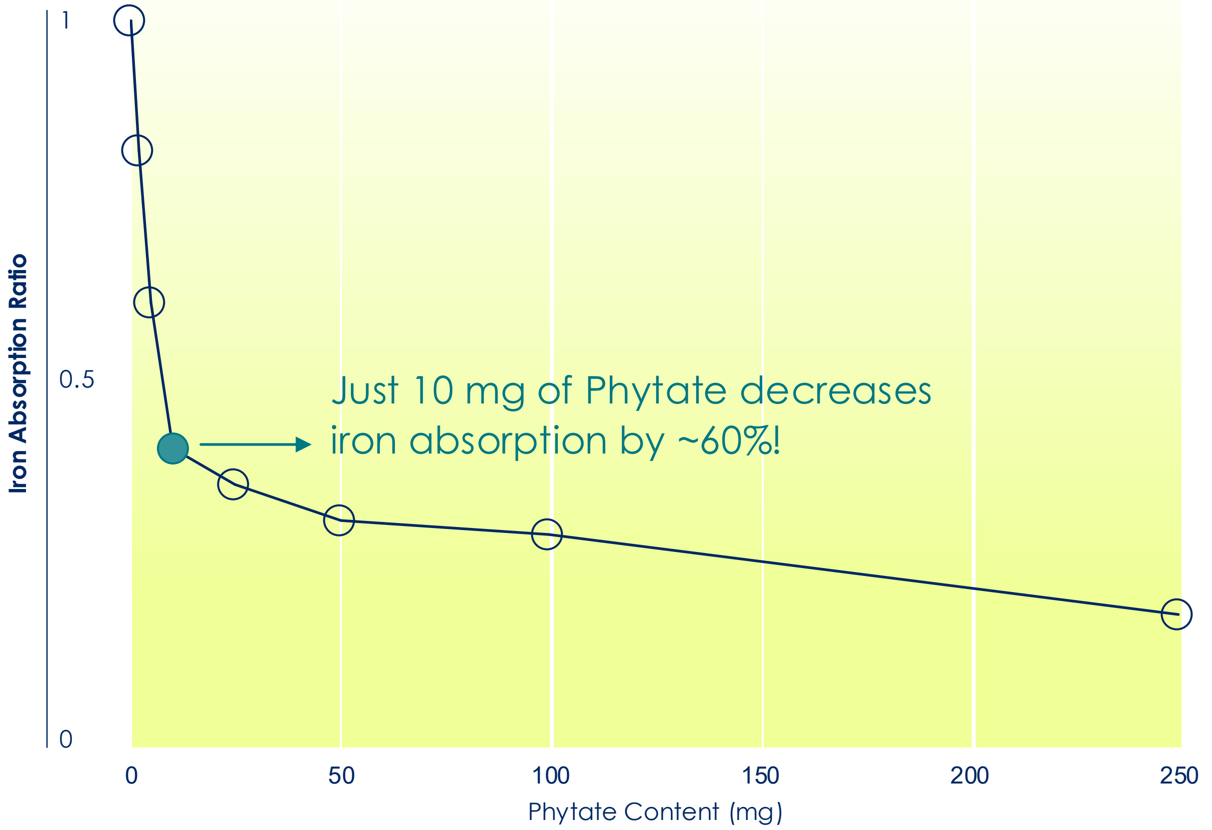
Phytates Decrease Iron Absorption from Foods

Population Characteristics

- Healthy males & females
- N=124, age 19-47 years

Study Design

- Subjects fed meals with 3 mg Fe (as $^{59}FeSO_4$) and varying phytate content (as Na Phytate)
- Iron absorption compared between phytate fortified and non-phytate fortified

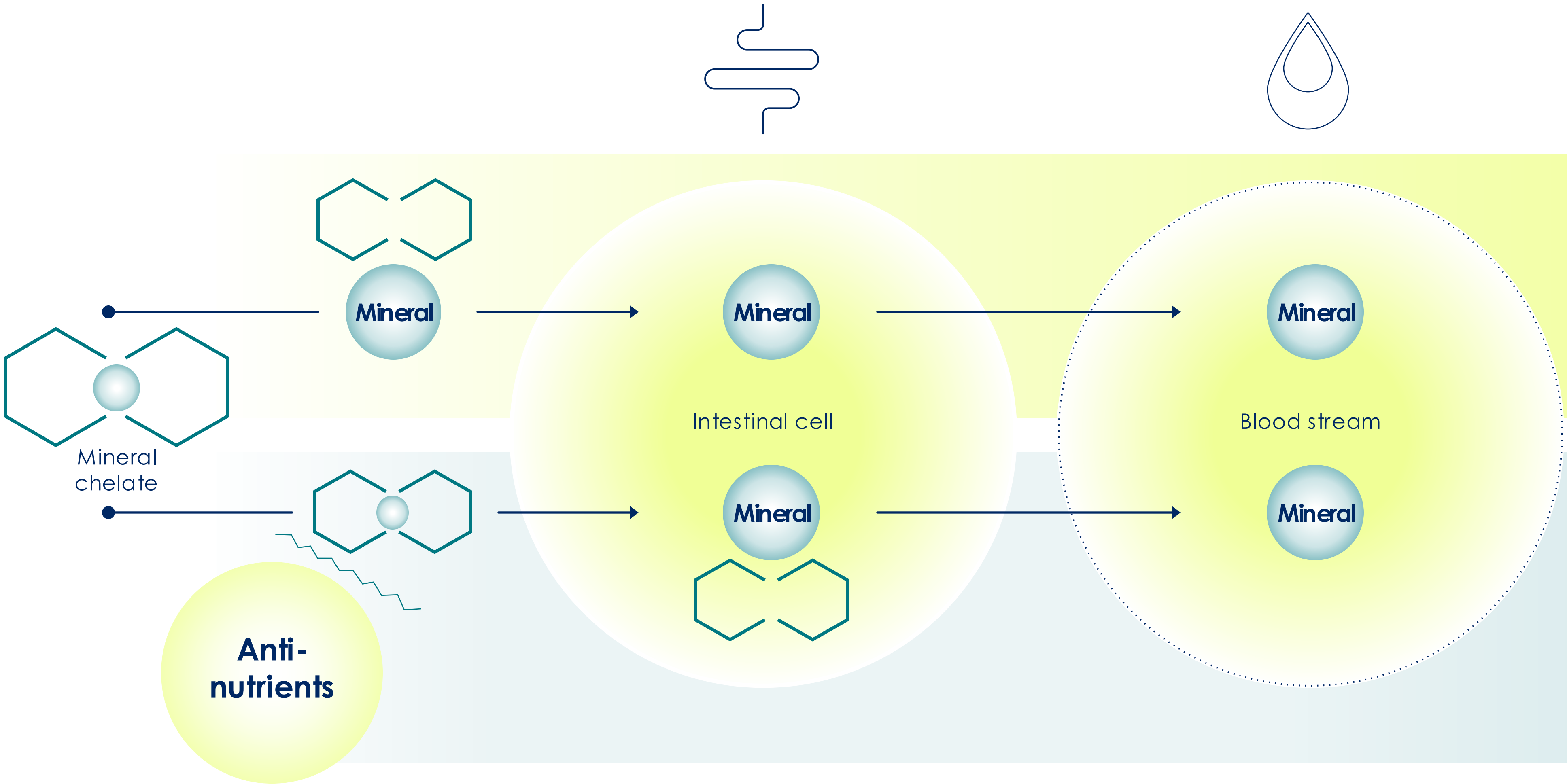


Conclusion

Dietary phytates decreased iron absorption (from Fe Sulfate) in a dose-dependent manner.

Source: Hallberg L, et al., Am J Clin Nutr 1989; 49: 140-4

What Happens to **Mineral Chelates in the Body?**



Fates of mineral chelates during digestion:

Form a charged ion and become **absorbed through the conventional pathway**

Remain chelated and **reduce binding of anti-nutrients**, then dissociate and enter the bloodstream

Ferrochel Absorption Is Well Studied

Author/ Publication	Study Design	Study Population	Duration/ Dosage	Primary Outcome	Conclusions
Pineda et al, J Appl Nutr 1994; 46(1-2): 2-13	Double blind, intervention trial	N=100 M&F, age 10-19 y; Hb <12 g/dL	**4 weeks** • 30 mg Fe bisglycinate • 60 mg Fe bisglycinate • 120 mg Fe bisglycinate • 120 mg $FeSO_4$ *all groups rec'd 250 mcg/day folic acid	Hemoglobin Ferritin Gastric Distress	• All treatments ↑hemoglobin • All treatments ↑ ferritin • GI distress from chelates was <50% of $FeSO_4$
Makled et al, J Eviden Base Wom Health 2020; 10(1): 95-103	Randomized, controlled trial	N=150 pregnant women with Hb between 8-10.5g/dL and serum ferritin < 15 mcg/L; age 19-37 y	**12 weeks** • Fe bisglycinate chelate (15 mg elemental Fe) • Fe dumarate (115 mg elemental Fe)	Hemoglobin	• Significant ↑hemoglobin higher in FeBisGly group • Significant ↑serum iron higher in FeBisGly group • Significant ↑ serum ferritin higher in FeBisGly group
Coplin MS et al; Clin Ther 1991; 13(5): 606-612	Randomized, double blind, crossover trial	N=42 premenopausal women w/ normal iron status; age 18-40 y	**14 days** 50 mg elemental iron as: • Iron bisglycinate • $FeSO_4$	Tolerability Subject preference	• Iron bisglycinate tolerated as well as $FeSO_4$ • Subjects reported higher preference for FeBisGly
Bovell-Benjamin AC, et al; Am J Clin Nutr 2000; 71: 1562-1569	Randomized intervention trial	**Study 1:** N=10 healthy M, age 19-30 y **Study 2:** N=33 healthy F, age 18-48 y	Whole-maize meal with either: • $FeSO_4$ • FeBisGly • FeTrisGly	Iron absorption (radioassay) Serum ferritin	• FeBisGly is better absorbed than $FeSO_4$ in whole maize meal

Hb = Hemoglobin, **Fe** = Iron, **FeSO4** = Ferrous sulfate, **Dx** = Diagnosis, **FeBisGly** = Iron bisglycinate

Ferrochel Is Better Absorbed Than $FeSO_4$ in the Presence of Phytates

Study Objective

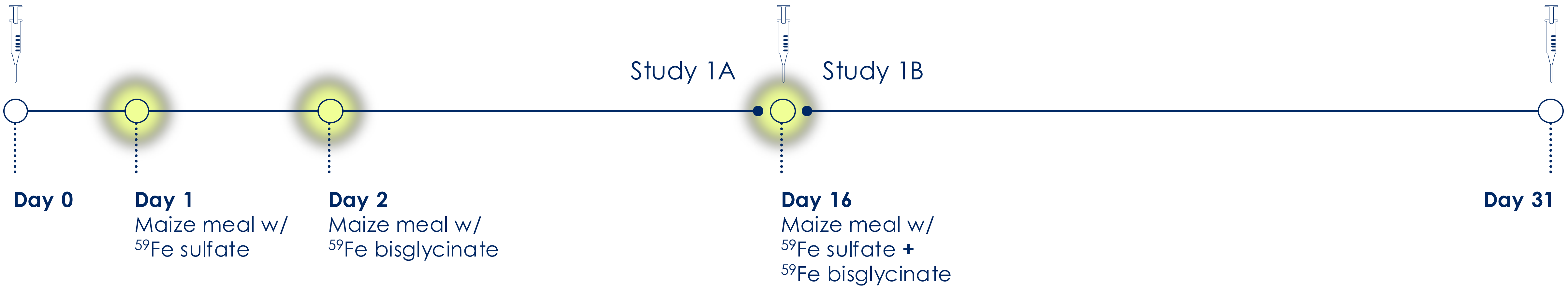
To compare iron absorption from different salt forms in whole-maize meal

Study Design & Population

- N=10 healthy males, ages 19-30 y
- 1.863 mg Fe/serving

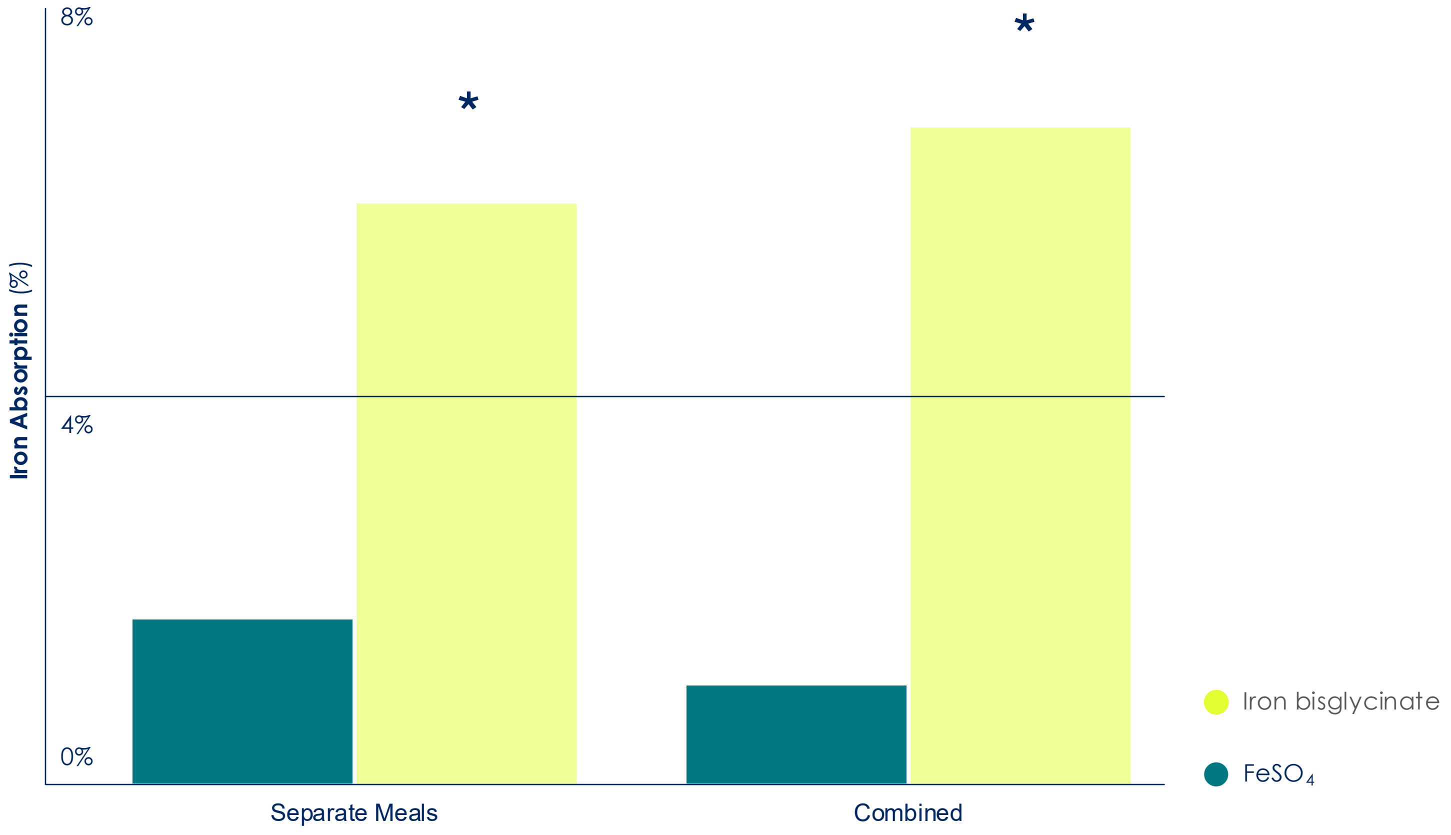
Primary Endpoint

- Iron absorption (radioassay)



Source: Bovell-Benjamin AC, et al; Am J Clin Nutr 2000; 71: 1563-1569

Ferrochel Is Better Absorbed Than $FeSO_4$ in the Presence of Phytates



Results & Conclusion

Iron from iron bisglycinate is **absorbed up to 4.7x better** than iron from Iron Sulfate in a whole maize meal.

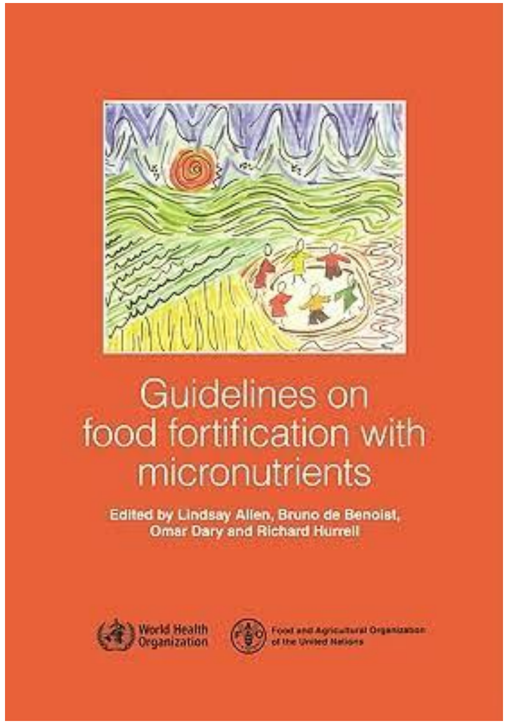
Iron bisglycinate is an effective and safe source of iron that is useful in phytate-rich diets.

Source: Bovell-Benjamin AC, et al; Am J Clin Nutr 2000; 71: 1563-1569

Iron Bisglycinate Is Recognized by the WHO

- **Absorption [of ferrous bisglycinate] is 2-3x better** than that of ferrous sulfate if the phytate content of the food vehicle is high.

Ferrous bisglycinate is listed as a **suggested iron fortificant for fluid milk and juice/ soft drink** applications.



Source: WHO/FAO, 2006. Guidelines on food fortification with micronutrients. Allen LH et al (ed).

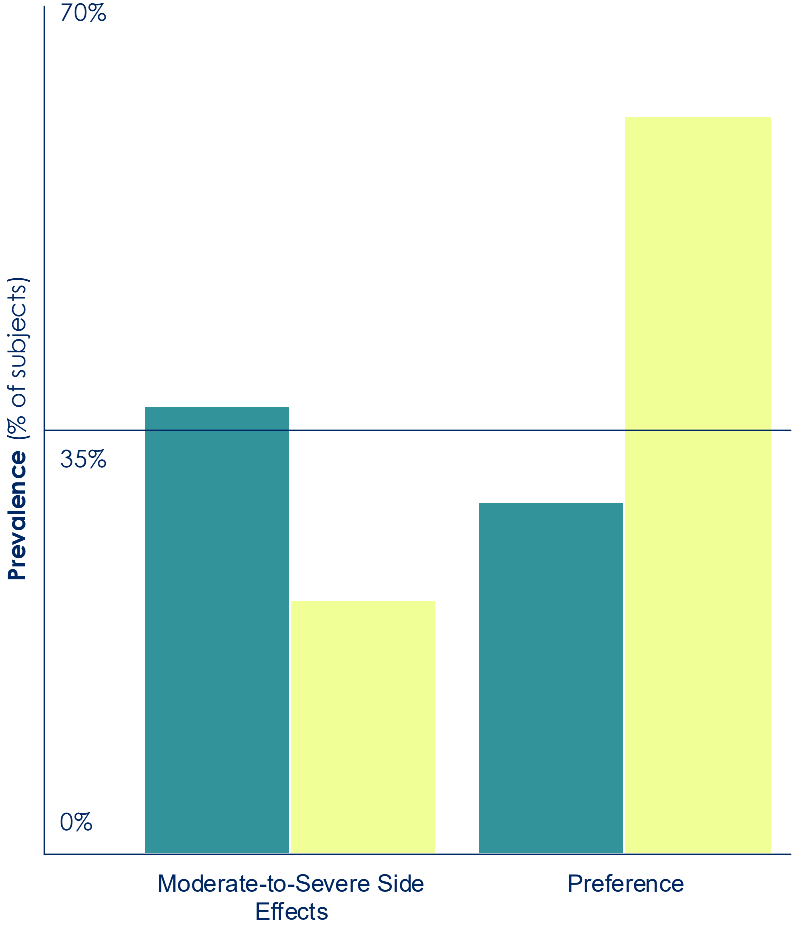
Women Prefer Ferrochel
Over Ferrous Sulfate

Study Population

N=42 healthy premenopausal women with normal iron status, age 18-40 years

Study Design

- Randomized, double-blind, crossover trial
- 14 day intervention
- 50 mg/day of elemental iron as:
  $FeSO_4$
  Fe Bisglycinate Chelate (Albion)



Ferrochel (Iron bisglycinate by Albion)

$FeSO_4$

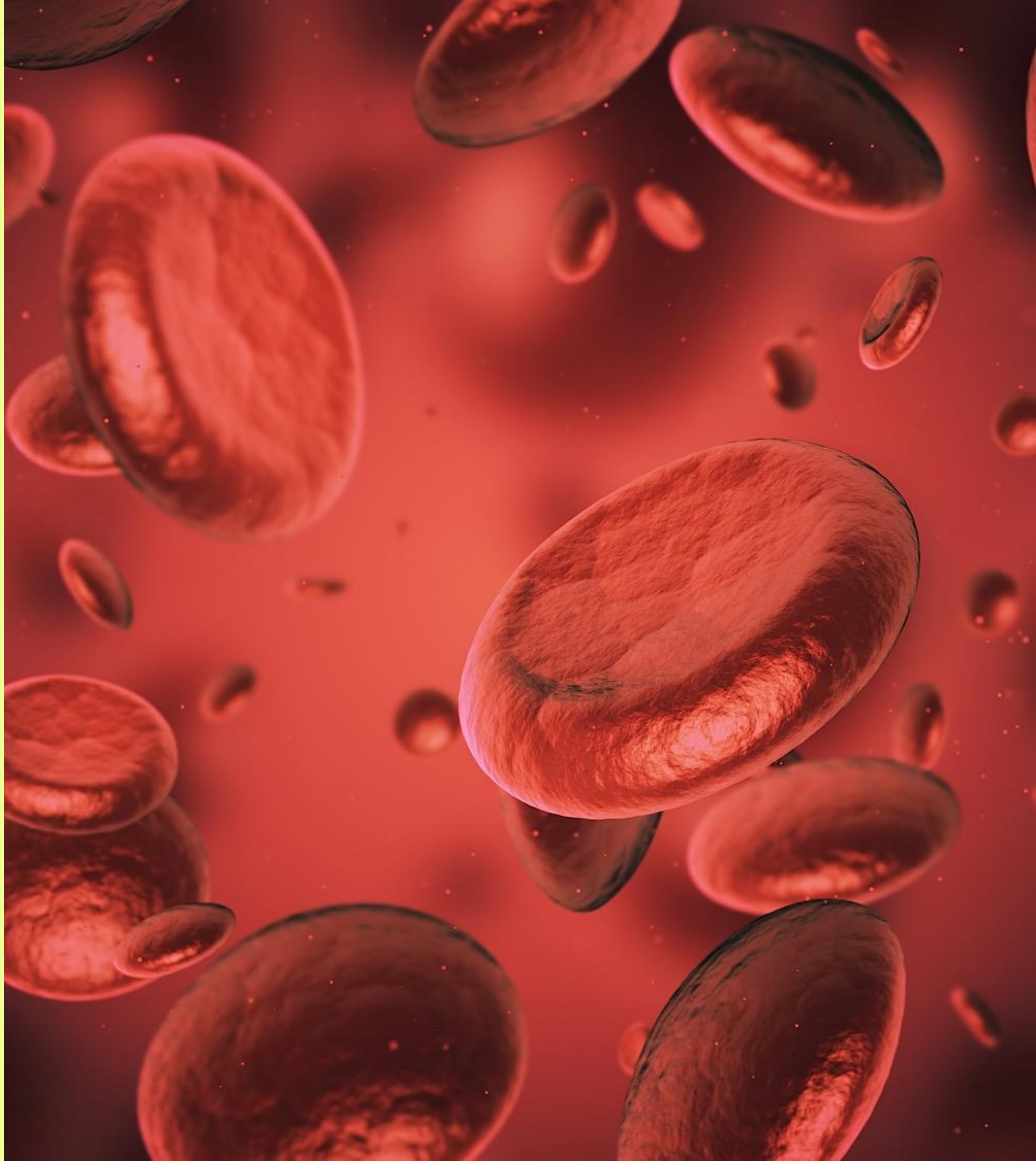
Conclusions

Iron bisglycinate chelate users experienced **fewer moderate-to-severe side effects** compared to $FeSO_4$.

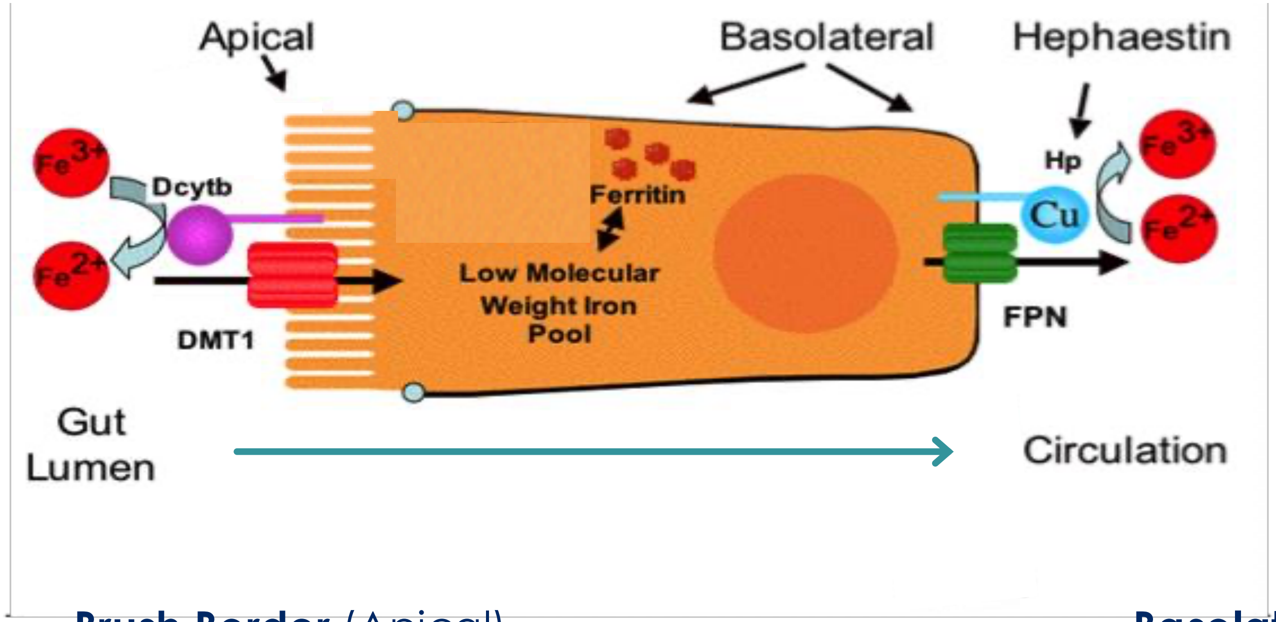
Women preferred Ferrochel nearly 2-to-1 compared to $FeSO_4$.

*Significant difference between groups, $p<0.05$ | Source: Coplin MS, et al., Clin Ther 1991; 13(5): 606-612

Potential Methods for **Maximizing Absorption**

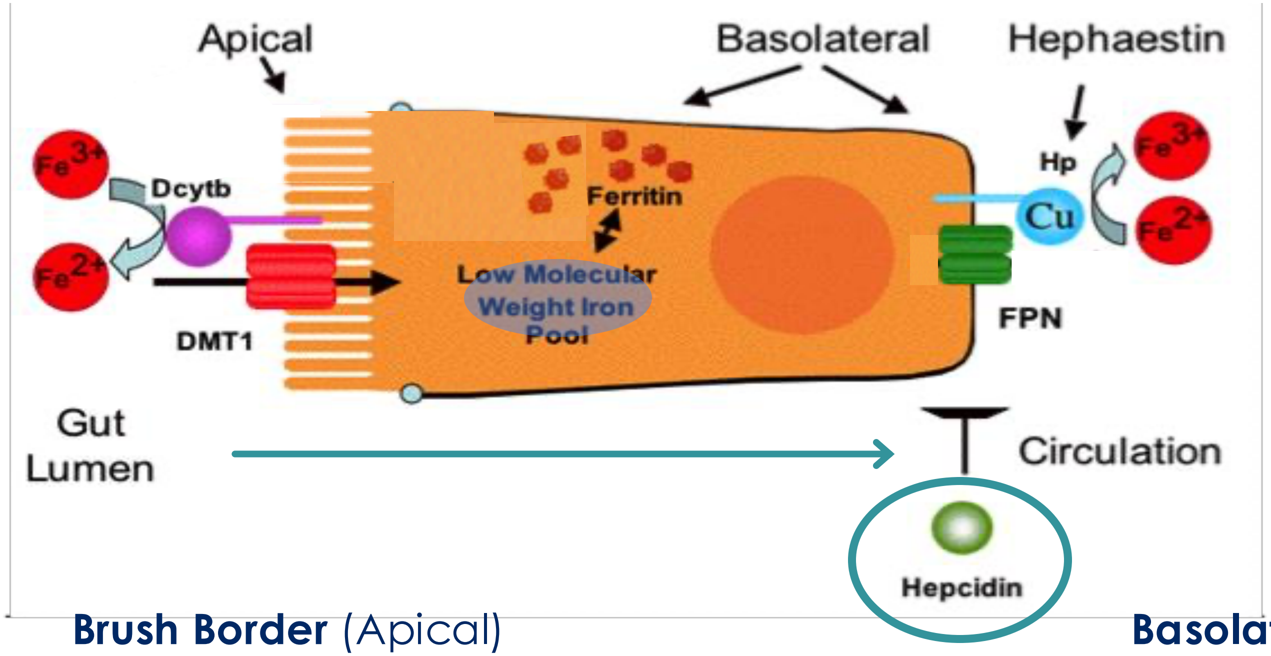


Iron Transport Through the Enterocyte



	Brush Border (Apical)	**Basolateral Membrane**
Redox Enzyme	Duodenal Cytochrome (ferric reductase) $Fe^{3+} \rightarrow Fe^{2+}$	Hephaestin $Fe^{2+} \rightarrow Fe^{3+}$
Transport Protein	Divalent Metal Transporter (DMT) Lumen → enterocyte	Ferroportin (Fpn) Enterocyte → circulation
Reservoir Protein	Ferritin 1000mg (liver & cells)	Transferrin 4mg (circulation)

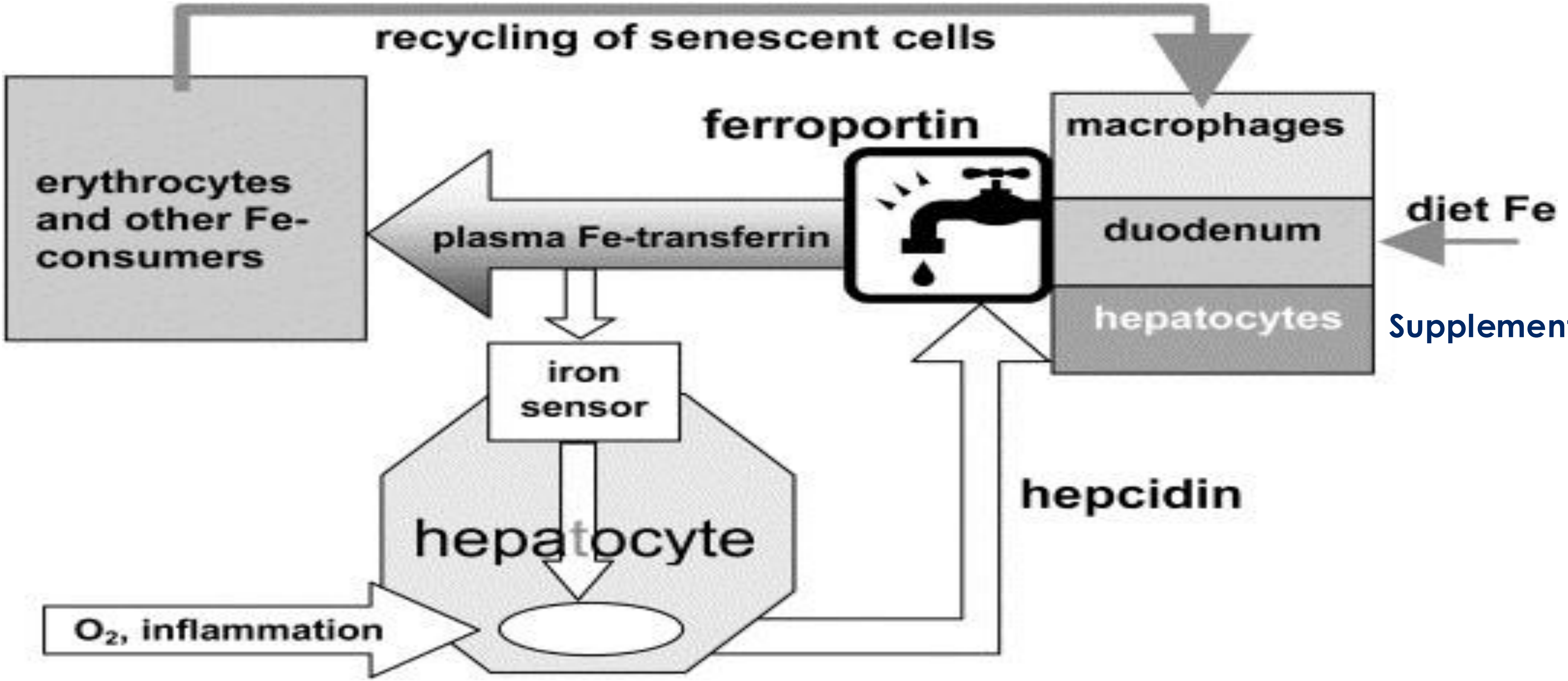
Iron Transport Through the Enterocyte



	Brush Border (Apical)	**Basolateral Membrane**
Redux Enzyme	Duodenal Cytochrome (ferric reductase) $Fe^{3+} \rightarrow Fe^{2+}$	Hephaestin $Fe^{2+} \rightarrow Fe^{3+}$
Transport Protein	Divalent Metal Transporter Lumen → enterocyte	Ferroportin (Fpn) Enterocyte → circulation
Regulators		Hepcidin **Inhibits Ferroportin (Fpn)**
Reservoir Protein	Ferritin 1000mg (liver & cells)	Transferrin 4mg (circulation)

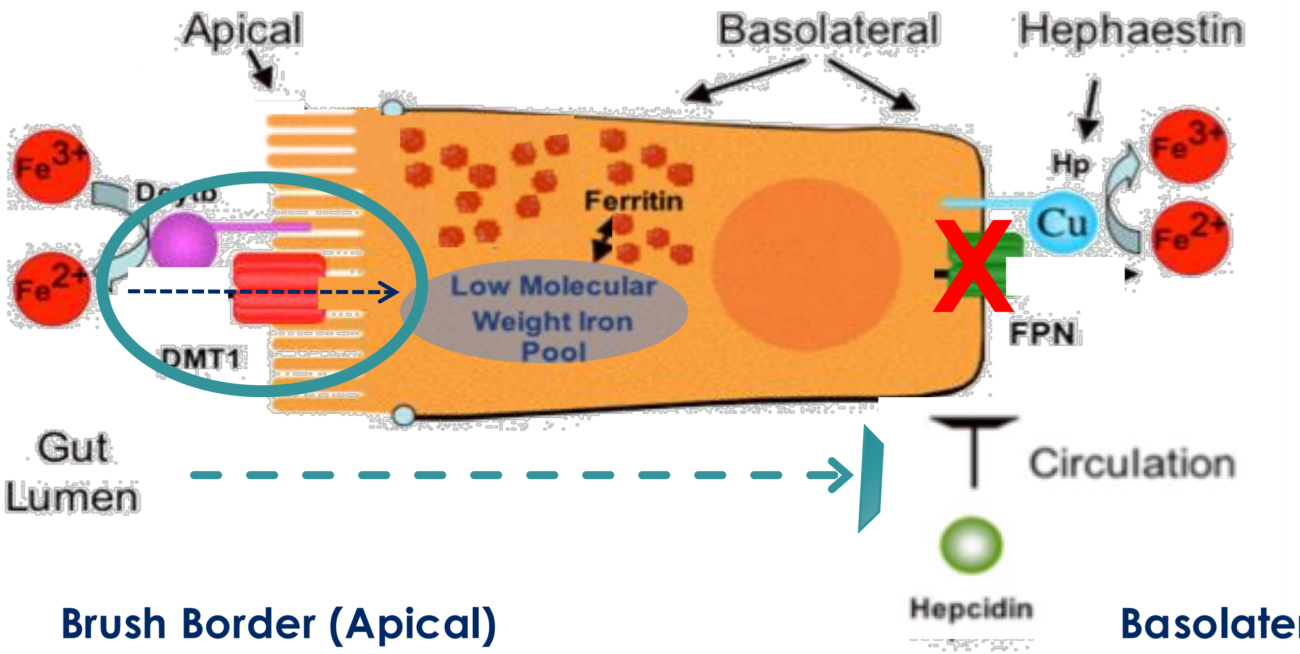
The Ferrous Faucet

Ferroportin Is the Only Way Out Of the Enterocyte



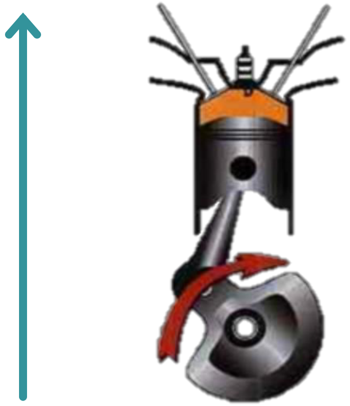
Supplemental Fe

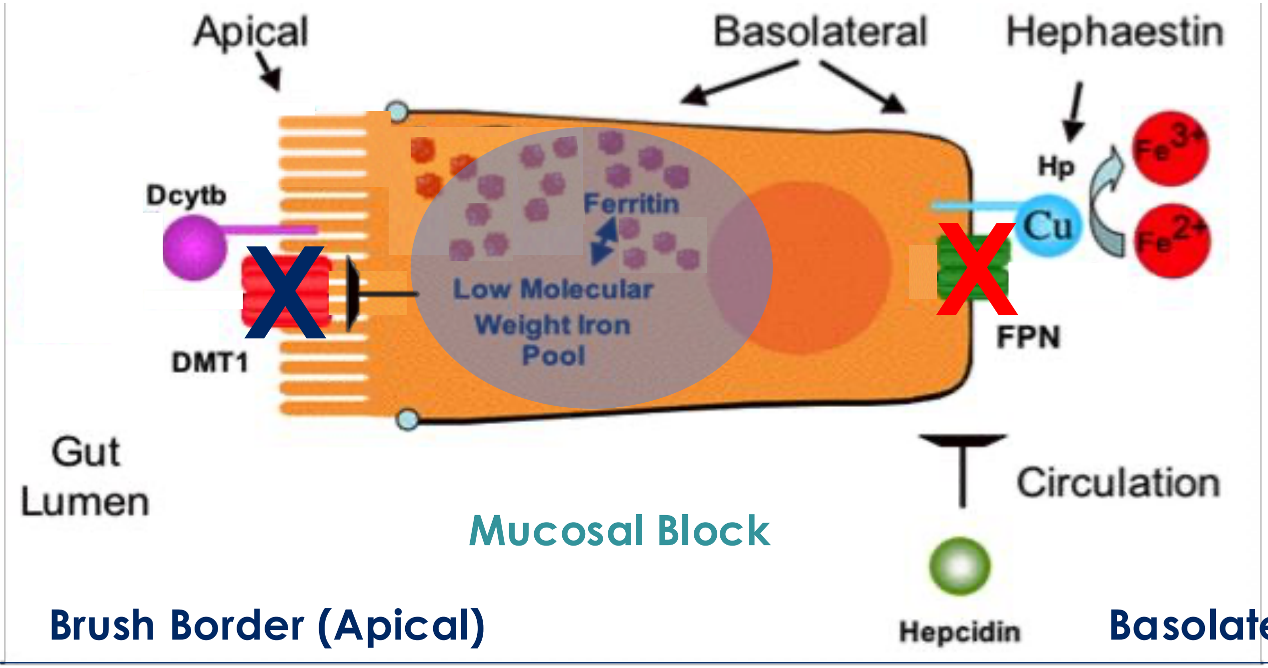
Iron Transport Through the Enterocyte



	Brush Border (Apical)	Basolateral Membrane
Redux Enzyme	Duodenal Cytochrome (ferric reductase) $Fe^{3+} \rightarrow Fe^{2+}$	Hephaestin $Fe^{2+} \rightarrow Fe^{3+}$
Transport Protein	Divalent Metal Transporter Lumen → enterocyte	Ferroportin Enterocyte → circulation
Regulators	LMW **Iron pool inhibits DMT**	Hepcidin **inactivates Ferroportin**
Reservoir Protein	Ferritin 1000mg (liver & cells)	Transferrin 4mg (circulation)

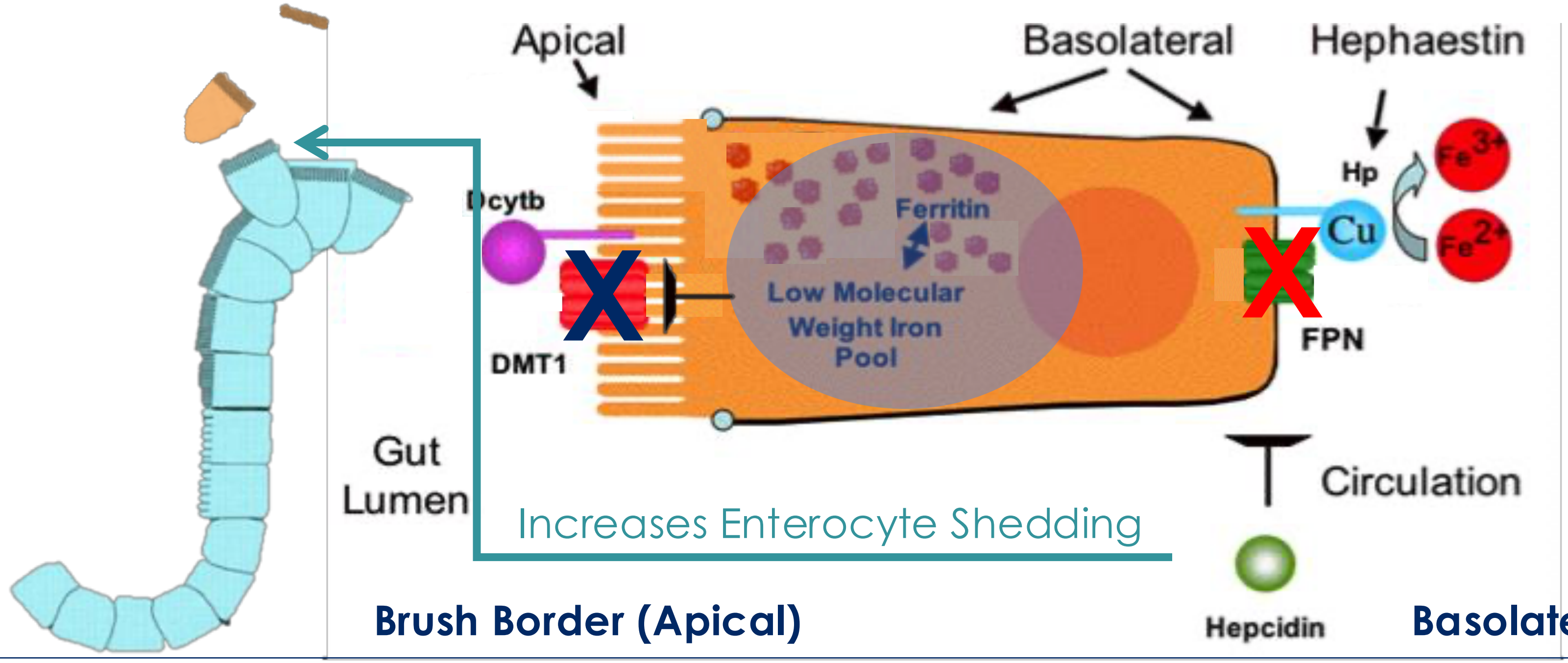
Iron Transport Through the Enterocyte





	Brush Border (Apical)	**Basolateral Membrane**
Redux Enzyme	Ferric Reductase Fe^{3+} → Fe^{2+}	Hephaestin Fe^{2+} → Fe^{3+}
Transport Protein	Divalent Metal Transporter Lumen → enterocyte	Ferroportin Enterocyte → circulation
Regulators	Iron pool expands & **shuts off DMT**	Hepcidin inactivates Ferroportin
Reservoir Protein	Ferritin 1000mg (liver & cells)	Transferrin 4mg (circulation)

Iron Transport Through the Enterocyte



	Brush Border (Apical)	**Basolateral Membrane**
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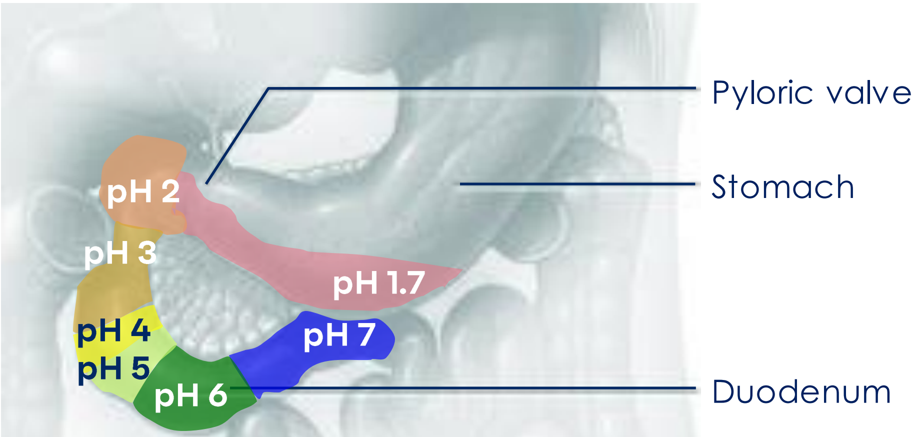
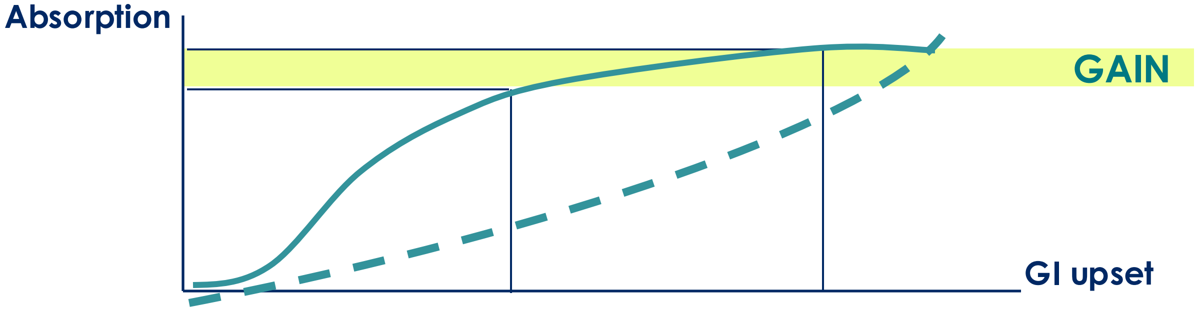
Transport Protein	Divalent Metal Transporter Lumen → enterocyte	Ferroportin Enterocyte → circulation
Regulators	Iron pool expands & shuts off DMT	Hepcidin inactivates Ferroportin and **↑ Enterocyte Shedding**
Reservoir Protein	Ferritin 1000mg (liver & cells)	Transferrin4mg (circulation)

Where Iron Unfolds Its Power

Ferrous or Ferric?



0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Battery acid	HCl in stomach acid	Lemon juice Vinegar Orange Juice		Acid rain	Black coffee	Urine Saliva	Pure water	Sea water	Baking soda	Ammonia solution		Soapy water	Bleach Oven cleaner	Drain cleaner



Source: Pharm Res. 1990 Jul;7(7):756-61

Iron Absorption

- Ferric iron (Fe+++) – oxidized form: usually precipitates easily which prevents absorption
- Ferrous iron (Fe++) – reduced form: usually 3-4 x more soluble and therefore absorbable than ferric iron

pH dependence is the rational
Even the ferrous form precipitates at pH > 3

pH < 3, ferrous form in solution & more easily absorbed

Repetitive Dosing

	Absorption			
	D 1-20	per day	20 D	90 Days
Ferrous Sulfate 74 mg tid (222 mg/d)	13.5%	30 mg	600 mg	2.7 g
$FeS0^4$ 222 mg/d alt c FeS04 + 1.1 g Succinic Acid	20.9%	46.4 mg	927 mg	4.2 g

Source: Hallberg et al, Scand J Hemat (1971) 8, 104-111

Repetitive Dosing

			Absorption			
	D 1-10	per day	20 D	D 21-30	per day	90 Days
222 mg Elemental Iron						
Ferrous Sulfate	14.5%	32.2 mg	644 mg	**5.1%**	11.3 mg	1.4 g
Fe + Succinic Acid	20.3%	45.1 mg	901 mg	**6.6%**	14.7 mg	1.9 g

Source: Hallberg et al, Scand J Hemat (1971) 8, 104-111

Iron Supplement Categories
Non-Heme Iron

Salts – inorganic
Sulfate
– gold standard

- Gluconate
- Fumarate

Elemental Iron

- Carbonyl iron

Organic

- **Saccharides**
  Polysaccharide Iron Complex (PIC)
- **Chelates**
  characterized by Dissociation Constant
  - Desferroxamine
    – binds iron very (too) tightly
  - Bis-glycinate (Ferrochel®)
    – binds iron less tightly
  - Ferrous aspartoglycinate (Sumalate®)
    – more soluble than Ferrochel®

Absorbability of Different Solutions Compared to Ferrous Sulfate

Ferrous succinate	**1.23 (23%)**
Ferrous lactate	1.06
Ferrous fumarate	1.01
Ferrous glycine sulfate	1.01
Ferrous sulfate	**1.0**
Ferrous glutamate	0.97
Ferrous glyconate	0.89
Ferrous citrate	0.74
Ferrous tartrate	0.62
Ferrous pyrophosphate	0.59
Ferrous cholinisocitrate	0.38
Ferrous versenate	0.24

Source: Hallberg B, Solvell Acta Med Scand (1962)17;(sup376) 11-22

FROM THE DEPARTMENT OF INTERNAL MEDICINE II (HEAD: E. WASSÉN M.D.), SAHLGRENSKA SJUKHUSET, UNIVERSITY OF GÖTEBORG, GÖTEBORG, SWEDEN.

SEARCH FOR SUBSTANCES PROMOTING THE ABSORPTION OF IRON

Studies on absorption and side-effects

By

LEIF HALLBERG, LENNART SÖLVELL AND HANS BRISE

In a previous report it was pointed out that the side-effects of iron tablets administered at a common dosage level were the same for 4 different ferrous compounds and that the sideeffects were significantly higher t… tablets (7).

It was concluded, … effectiveness of oral i… necessary to focus … absorbability of differ… and on factors whic… absorption of iron. … of iron compounds h… in a previous study (2… presents studies on… may increase the abs…

To investigate the … substance which prom… it is necessary to stu… absorption but also … to compare the resu…

tained with a usual oral iron compound, e.g. ferrous sulphate.

Succinic acid (4) and ascorbic acid (3) have earlier been shown to increase the absorption of iron. Studies on the thera-

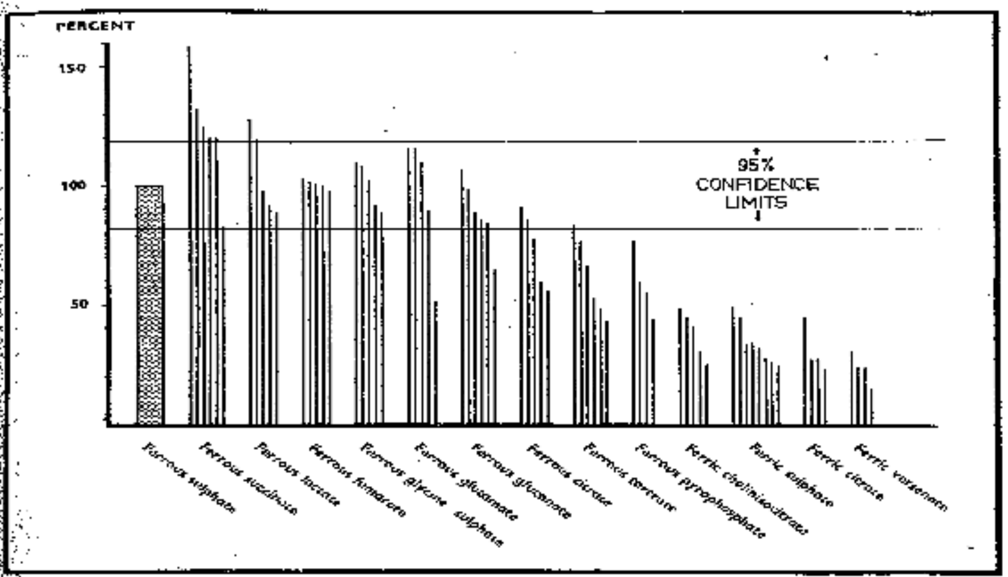


Fig. 2. Absorbability of different iron compounds (solutions). Individual values in relation to ferrous sulphate.

In the absorption … mental design and the analytical procedures were the same as in previous studies

30 mg elemental iron and labelled with radioiron was given orally for 10 days

The Search

Promoters
Carbohydrates
4 g with 30 mg Iron

• Mannitol	1.74 (74%)
• Sorbitol	1.41
• Xylose	1.32
• Inositol	1.05
• Fructose	1.03
• Sucrose	1.02
• Lactose	0.85
• Sorbitol (14g)	2.71
• Sorbitol (8g)	1.62
• Glucose (14g)	0.78
• Mannitol (4g IV)	1.1

Side Effects

Epigastric discomfort

Marked increased bowel movements

MOA Hypothesis

Iron still in the ferrous state may rapidly be distributed over a greater intestinal area thereby facilitating greater absorption

The Search Continues

Ascorbic acid

Succinic acid

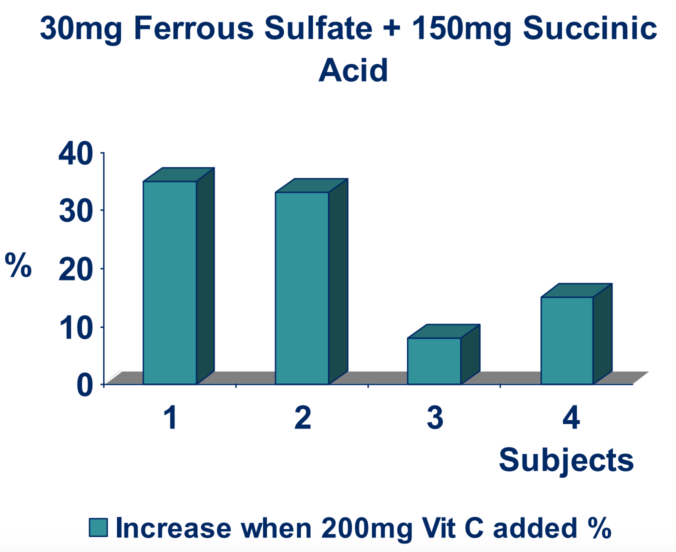
Can’t Be

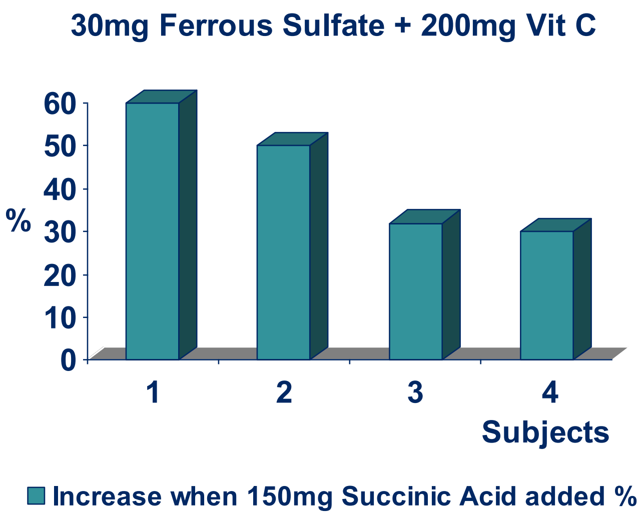
- **Simple acid effect**
  Other related acids didn’t increase absorption
- **Reducing agent**
  When given with optimal amounts of ascorbic acid (a potent reducing agent), its ability to increase absorption wasn’t diminished at all
- **Gastro-intestinal content modifier**
  When given intravenously, it worked just as well
- Due to an **increased area of absorption**
  No change in gastro-intestinal motility

Leaving …

Increased transfer of iron across the basolateral cell membrane of the intestinal mucosal cell.

Comparative Effects of Vitamin C & Succinic Acid





Mean increase in absorption 23%
i.e. effect of vitamin C

Mean increase in absorption **43%**
i.e. effect of succinic acid

Source: Brise, H, Hallberg L et al Acta Med Scand 1962;17(sup 376)59-73

Effect of New Treatment Regimen & **Combination of Iron Promoters**

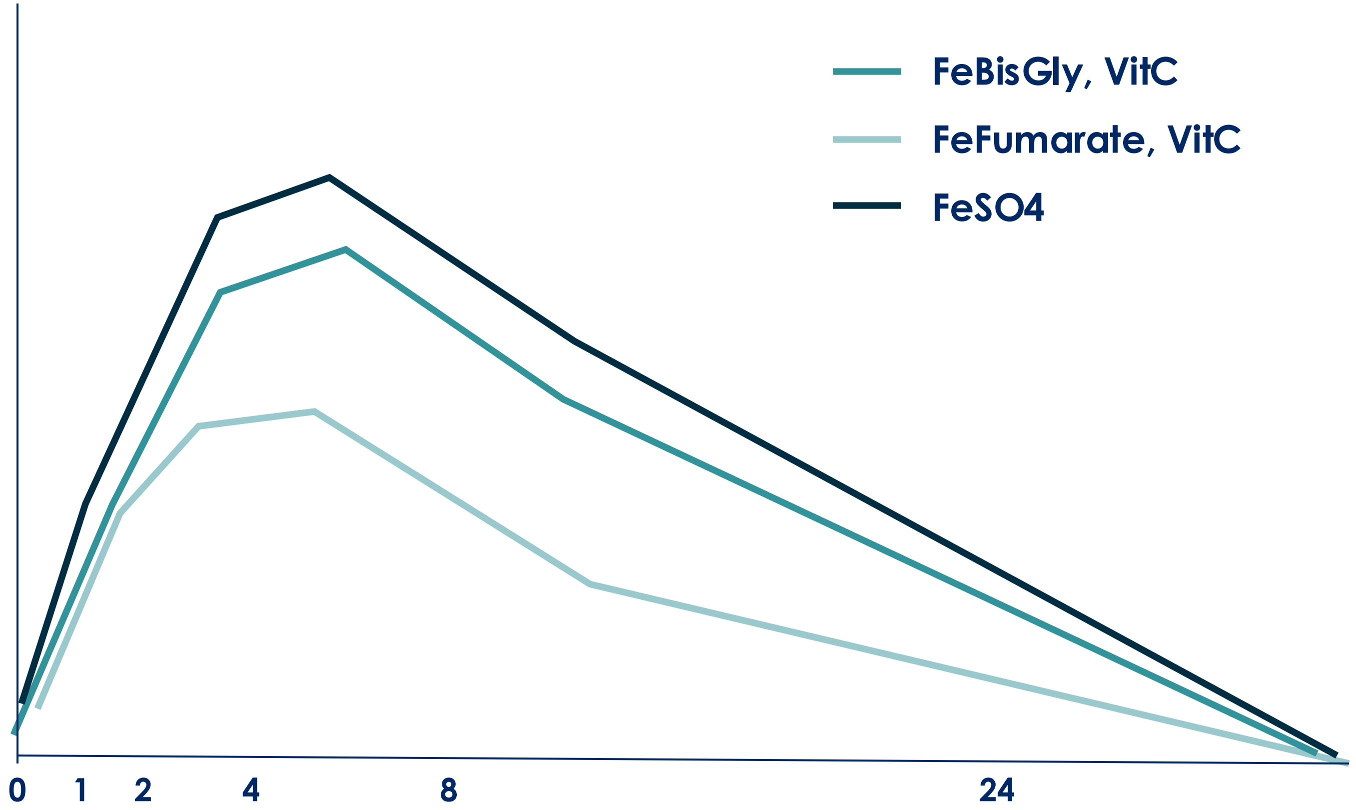
Comparison of total iron absorbed and RBC regeneration at
1 month 2 months 3 months

Weeks	1	2	3	4	5	6	7	8	9	10	11	12
Arm 1 CF w/out EsterC Intermittent	*				*				*			*
Arm 2 CF w 150Sux 200 ascorbic Intermitt	*				*				*			*
Arm 3 CF w/out Ester C Continuous	*				*				*			*
Arm 4 FeoSol 130mg wk 1-4 Ferochel70mg+150Sux 9-11	*				*				f70S *			*
Arm 5 CF w 150Sux wk1-3	*				*							
Arm 6 Placebo	*											
	* 24 Hour Serum Iron Profile										Total	

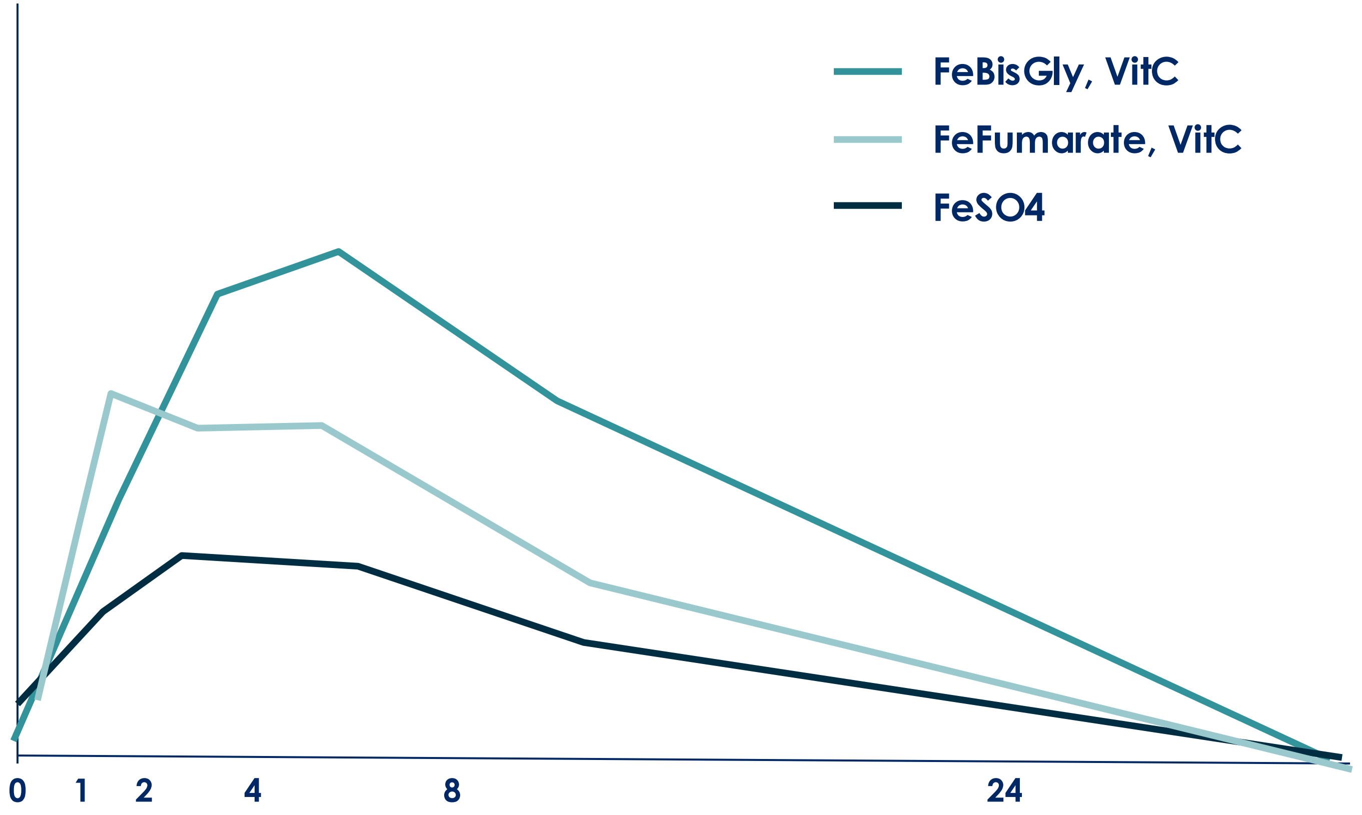
Head to Head comparison on Supplement Holiday vs Continuous Controls x 2 – iron & RBC

Head to Head comparison of iron absorption and RBC for Supplement Holiday Effect vs control

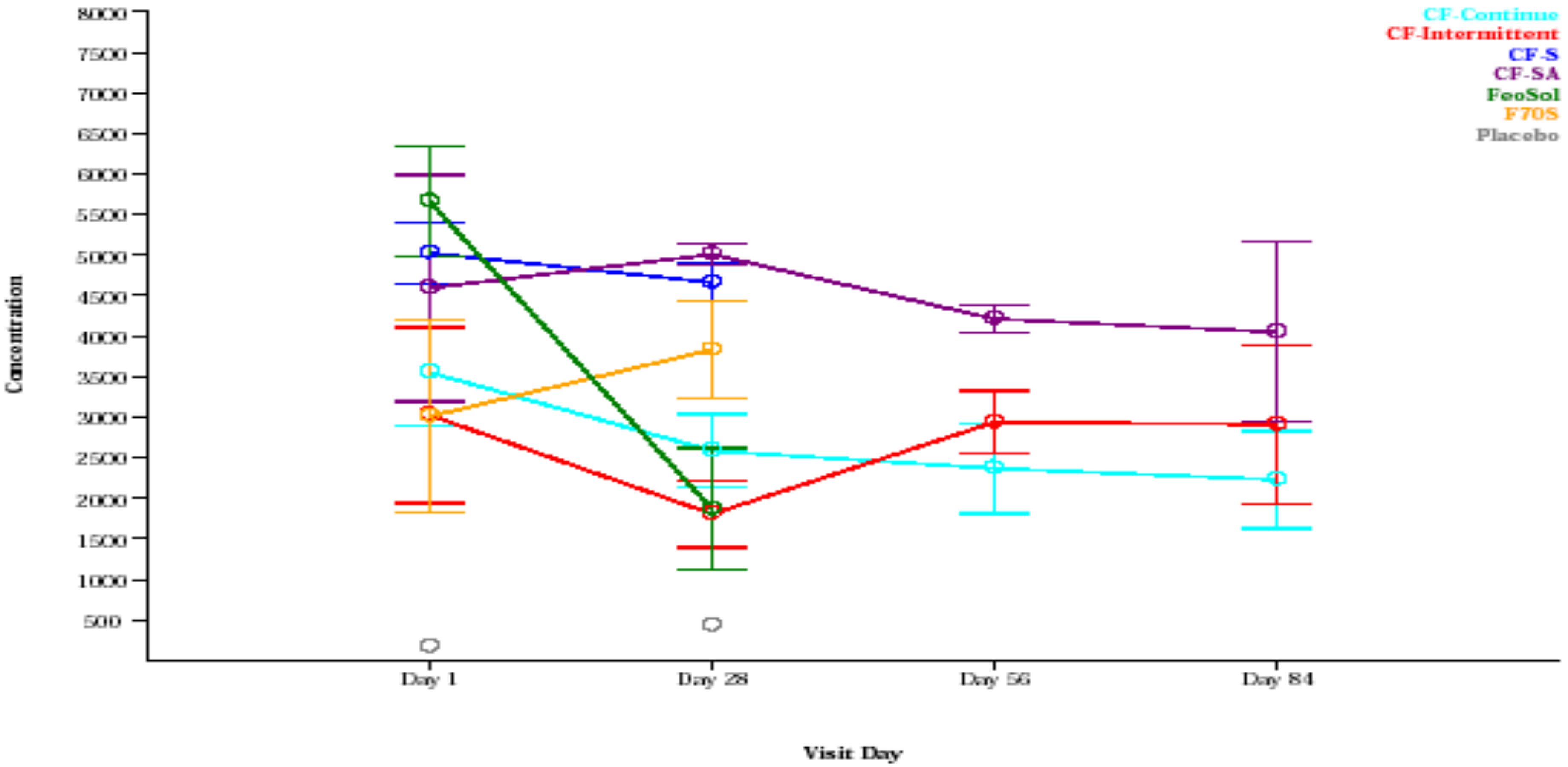
Mean Serum Iron AUC Treatment Day 1



Mean Serum Iron AUC Treatment Day 28



Mean Estimated and Adjusted AUC
by Treatment at Hours 0-24 (APP)



Summary: **Iron Bisglycinate is the Superior Choice**

Iron is an essential mineral that provides multiple health benefits by supporting healthy red blood cells, immune health, and cognitive health, yet many Americans do not get enough iron in their diet.

Commonly used inorganic iron salts have poor solubility and their absorption can be negatively impacted by anti-nutrients such as phytates.

By binding minerals to amino acids such as glycine, **mineral chelates have enhanced solubility and limited interaction with other dietary components, leading to enhanced absorption**.

Clinical data demonstrates that iron bisglycinate chelate has **better absorption (nearly 5x higher) in the presence of anti-nutrients and greater tolerability** compared to traditional iron salts.

Iron bisglycinate chelate is an **excellent option for brands** looking to provide Iron health benefits with an exciting and different technology.

Intermittent Treatment regime supports maximum absorption by increasing enterocyte shedding and removing mucosal block

Ferrochel®
Albion Minerals

Designs for Health
Ferro Supreme

Iron Glycinate and Calcium Ascorbate

Active ingredients per hard capsule:

Iron (II) Glycinate	120 mg
Equiv. iron	24 mg
Calcium ascorbate dihydrate	219.08 mg
Equiv. ascorbic acid (vitamin C)	180 mg

Thanks for your participation!

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Questions & Discussion

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