

TRICK OR TREAT



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(EAR) – 50%

, EAR,

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(RNI) –

(EAR) 2 () ,

, RNI,

=

(UL) –

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1. Lowest recommendation nutrition intake to prevent deficiency - **LRNI**
2. Estimated average requirement of nutrient - **EAR**
3. Recommendation daily allowance of nutrient - **RDA**
4. Recommended nutritional intake - **RNI**
5. Minimum - minimum required nutrition intake to prevent deficiency
6. Adequate nutritional intake

- 1.
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Requirement - EAR), 100% (Estimated Average Requirement)

100 % (100%) (Recommended Dietary Allowance - RDA = EAR 97,5 100%)

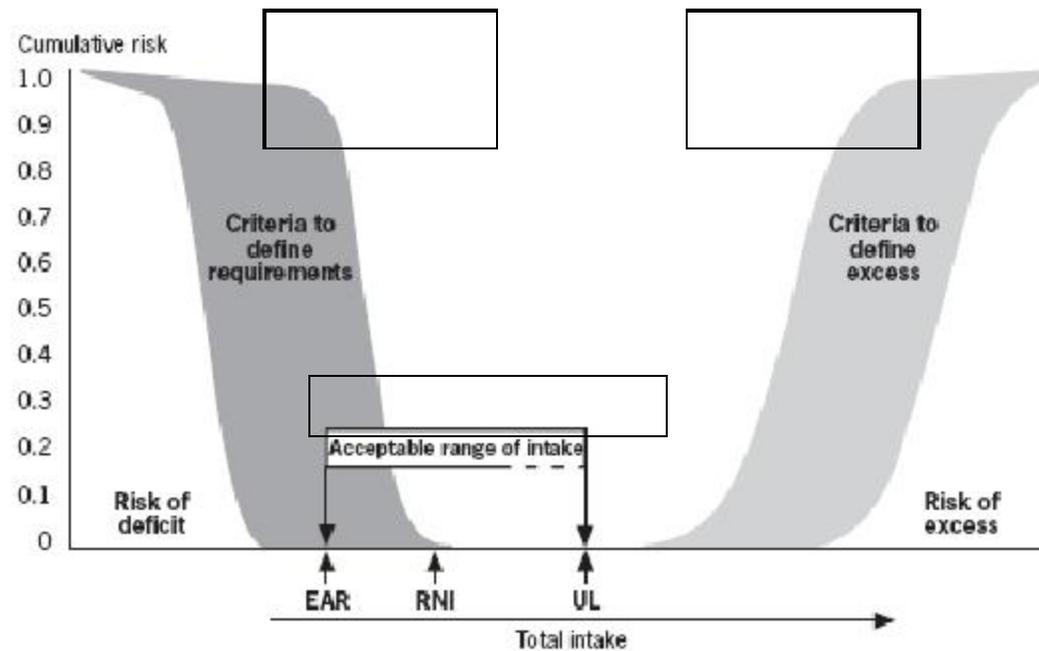
97,5% RDA (Recommended Dietary Intake- RDI RNI), EAR

132 , RDA - 0,65-0,83 /William M et all 2003/ EAR 105-



FIGURE 1.1

Risk function of deficiency and excess for individuals in a population related to food intake, assuming a Gaussian distribution of requirements to prevent deficit and avoid excess



The shaded ranges correspond to different approaches to defining requirements to prevent deficit and excess, respectively. The estimated average requirement (EAR) is the average daily intake required to prevent deficit in half of the population. The recommended nutrient intake (RNI) is the amount necessary to meet the needs of most (97.5%) of the population, set as the EAR plus 2 standard deviations. The tolerable upper intake level (UL) is the level at which no evidence of toxicity is demonstrable.



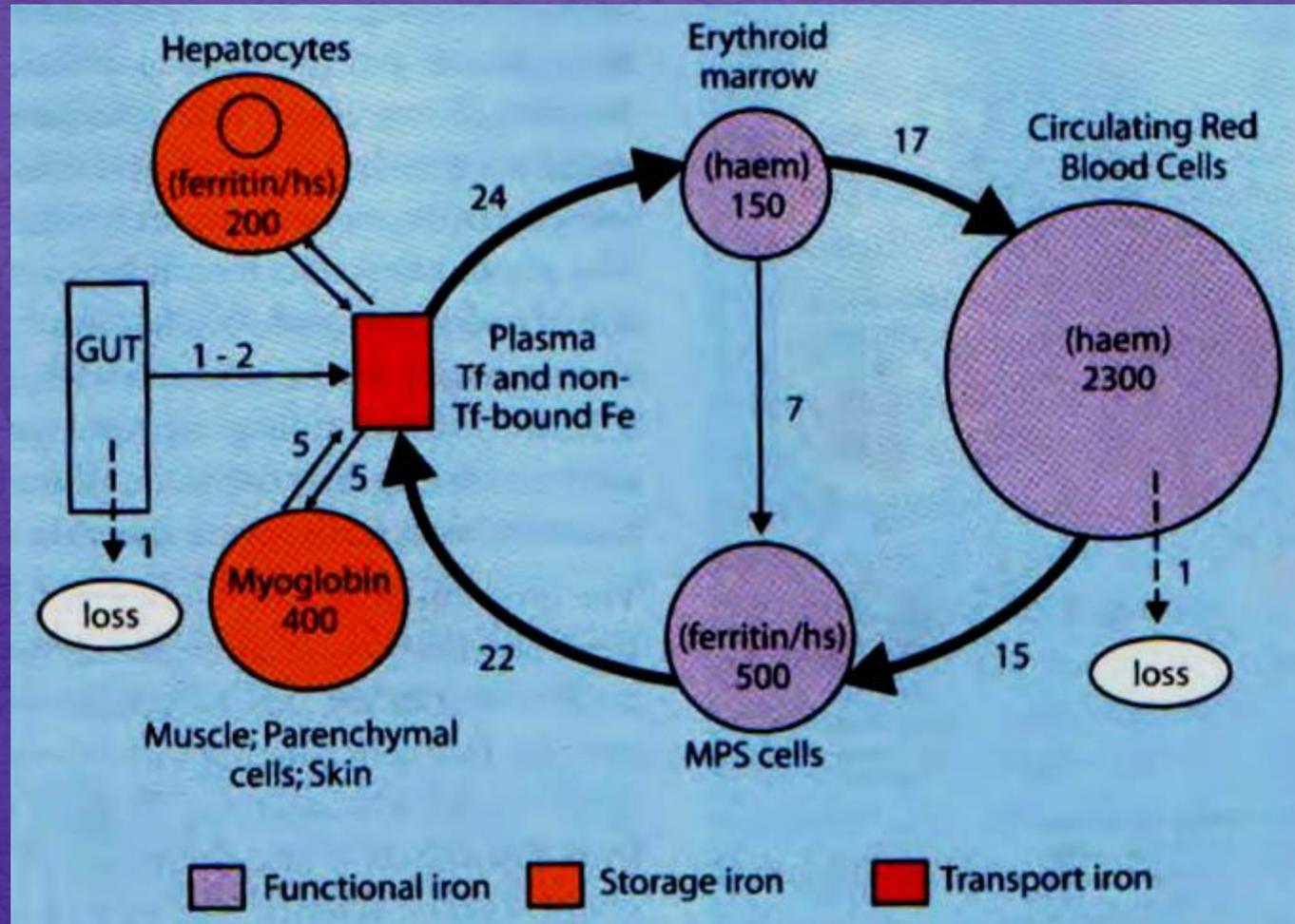
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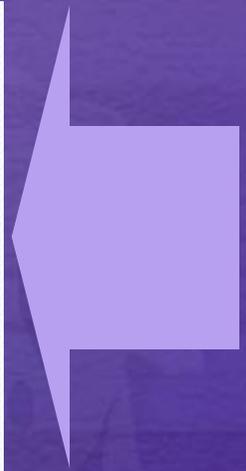
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	Man, 70 kg Hb 160 g/L	Man, 100 kg Hb 180 g/L	Woman, 45 kg Hb 120 g/L
'Essential' iron			
Hb Fe	2,67 g	4,2 g	1,26 g
Functional tissue iron*	~0,45	~0,64	~0,29
Transport iron	~0,005	~0,007	~0,003
'Non-essential' iron			
Storage iron	0,5 - 1,5	0,5 - 1,5	0,3 - 1,0
Total: as low as			<2 g
as high as		> 6 g	
* Myoglobin, metalloenzymes			



Fairbanks VF, Beutler E. Iron. In: Shils ME, Young VR, eds. Modern Nutrition in Health and Disease. 7. ed. Philadelphia: Lea & Febiger 1988:193-226.



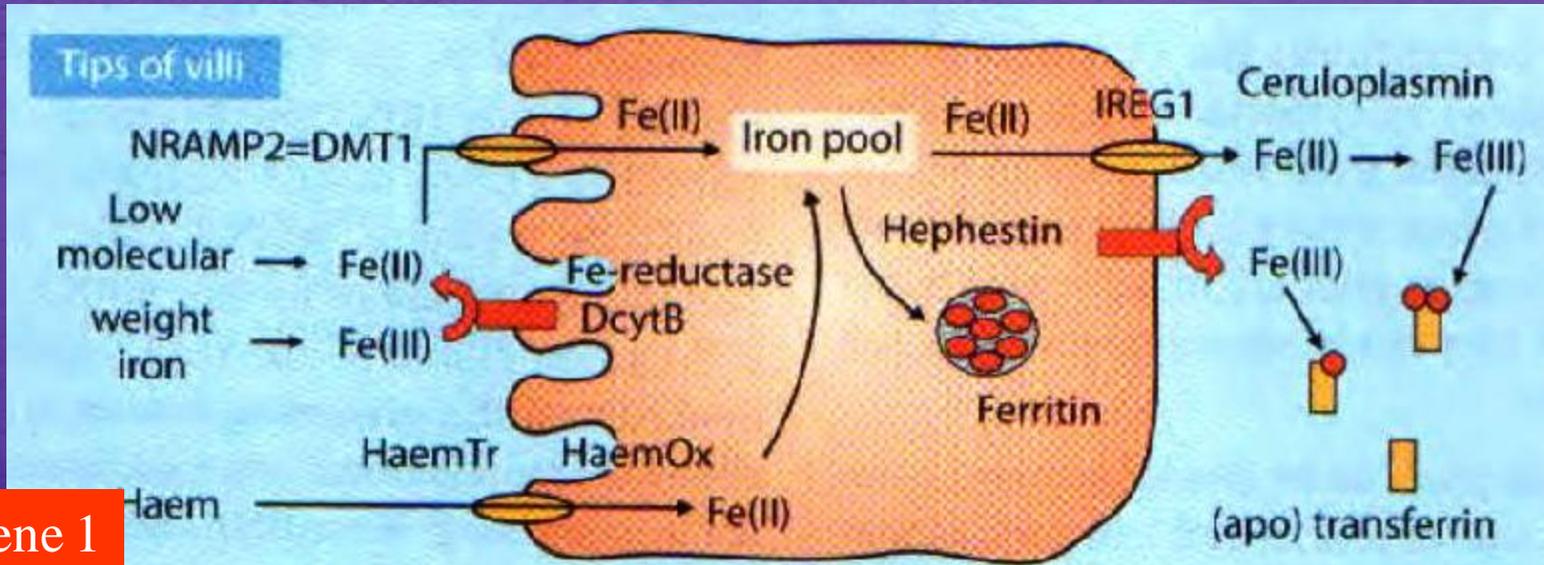
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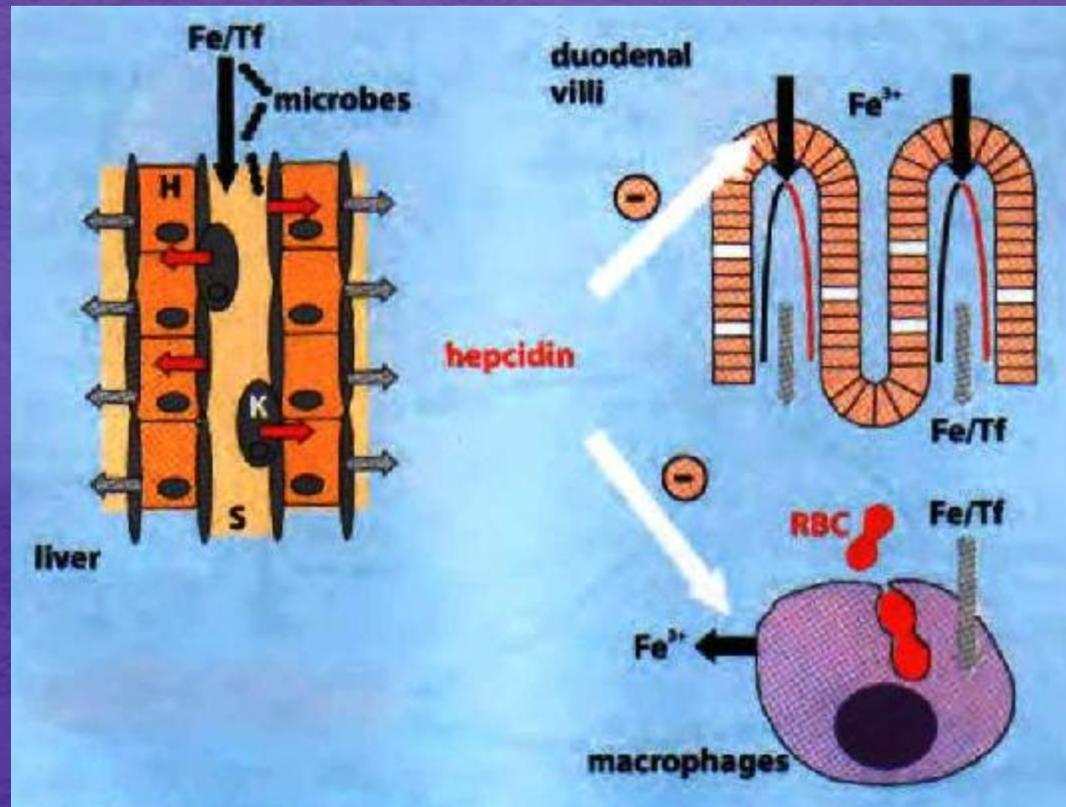


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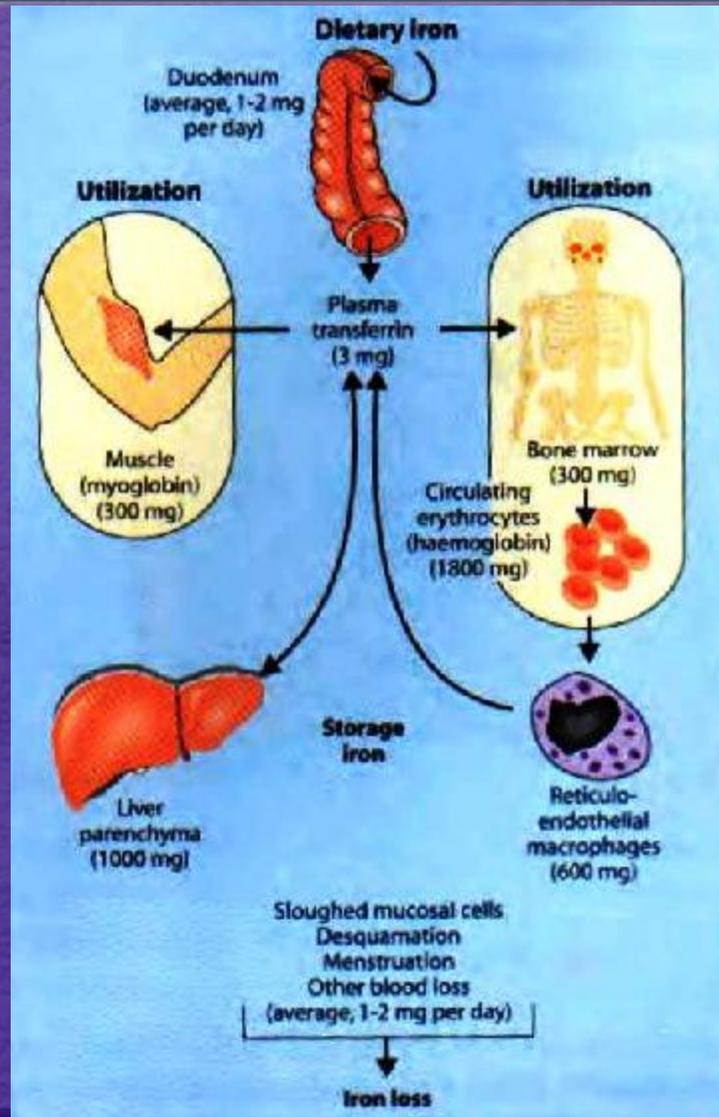


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(hepcidin),
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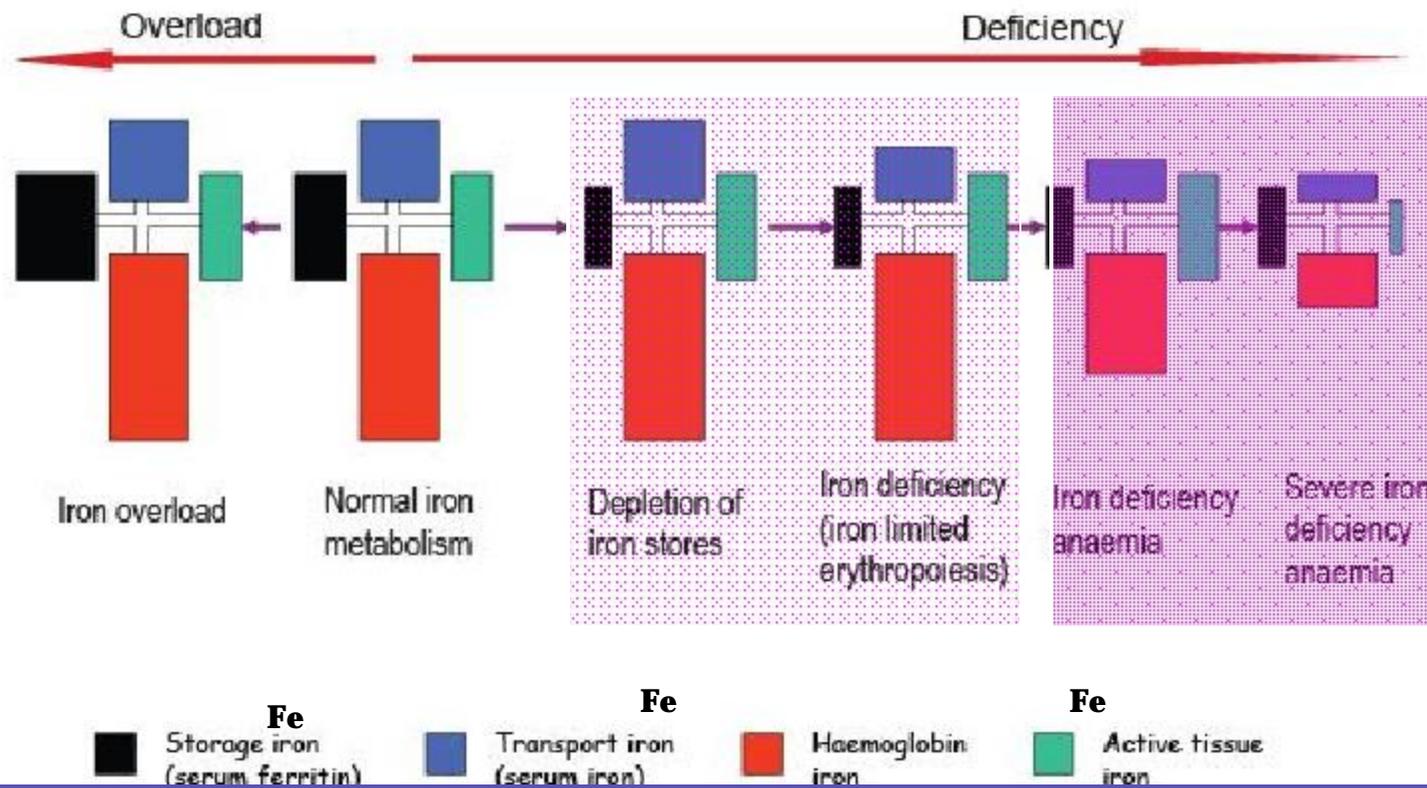


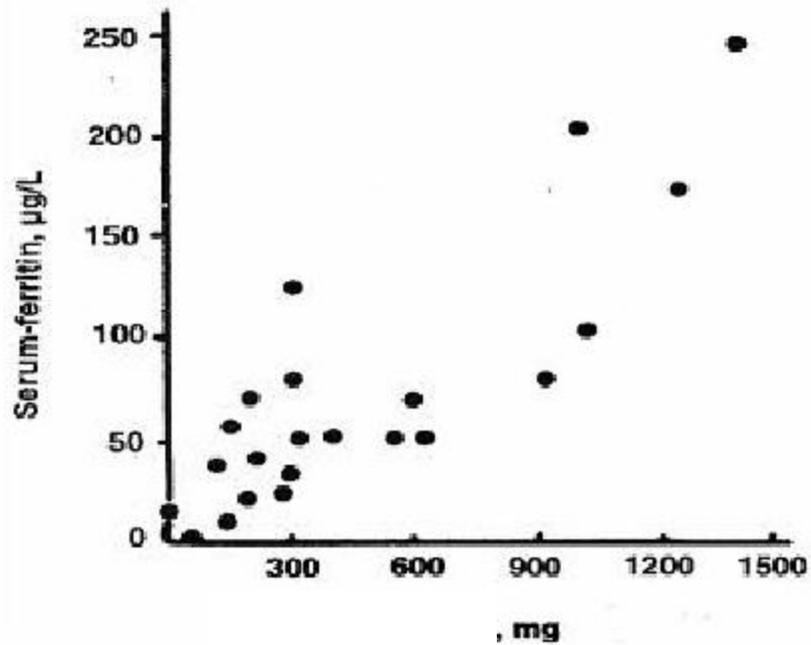
Focusing on anaemia

*Anaemia is an indicator of both
poor nutrition and poor health.
World Health Organization, 2004*



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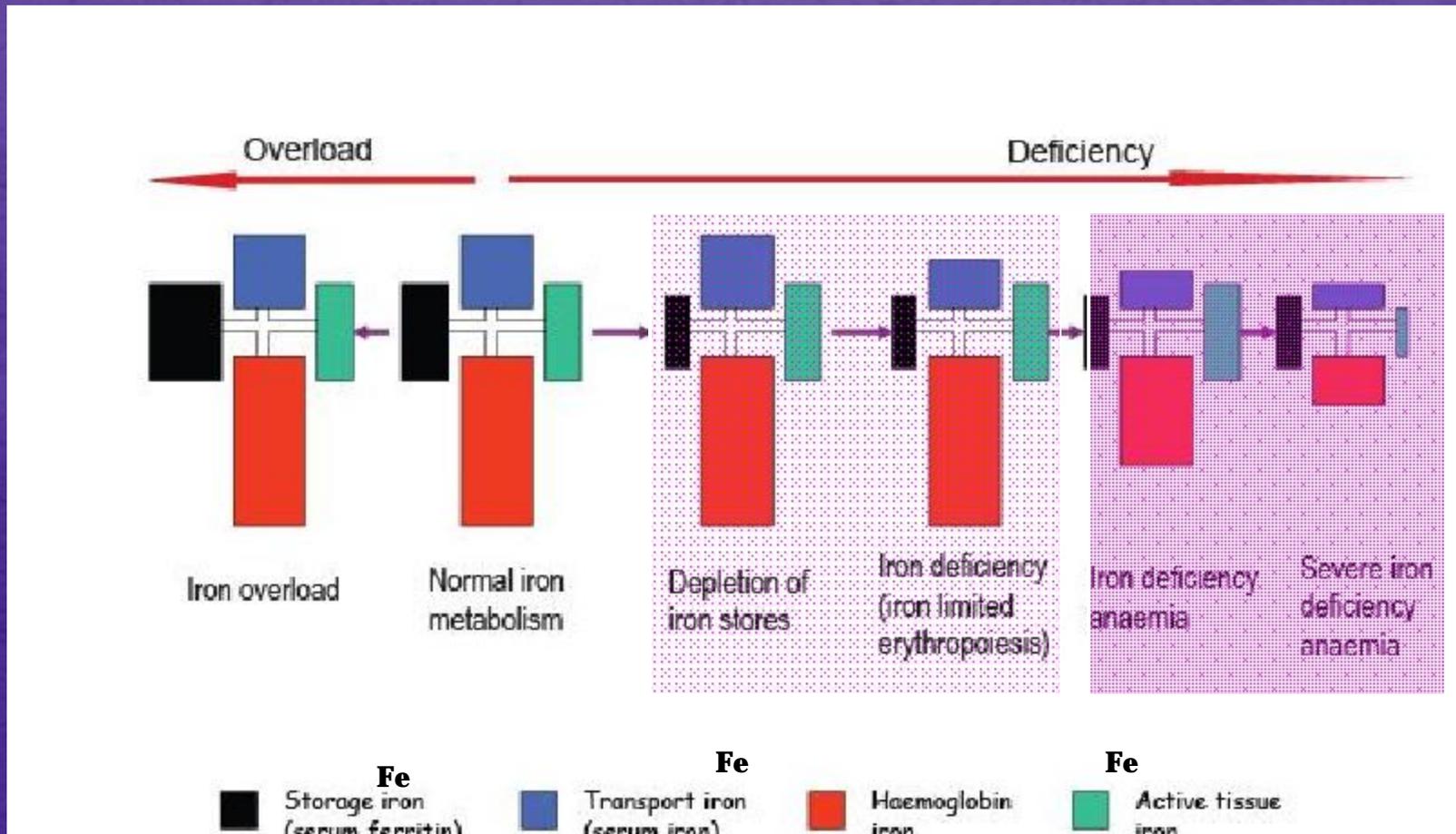




Walters GO, Miller FM, Worwood M. Serum ferritin concentration and iron stores in normal subjects J Clin Pathol 1973;26:770-2.



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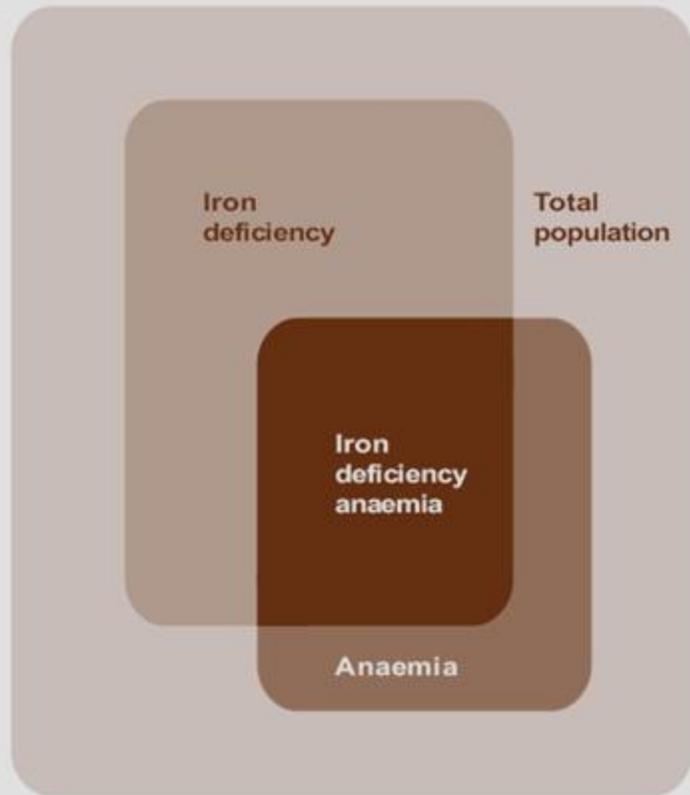


S-ferritin - correlates with storage iron in healthy individuals ($\mu\text{g/L}$).

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Figure 1. Conceptual diagram of the relationship between iron deficiency and anaemia in a hypothetical population



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(TfR - Transferrin Receptor in serum)
(FEP - Free Erythrocyte Protoporphyrin)



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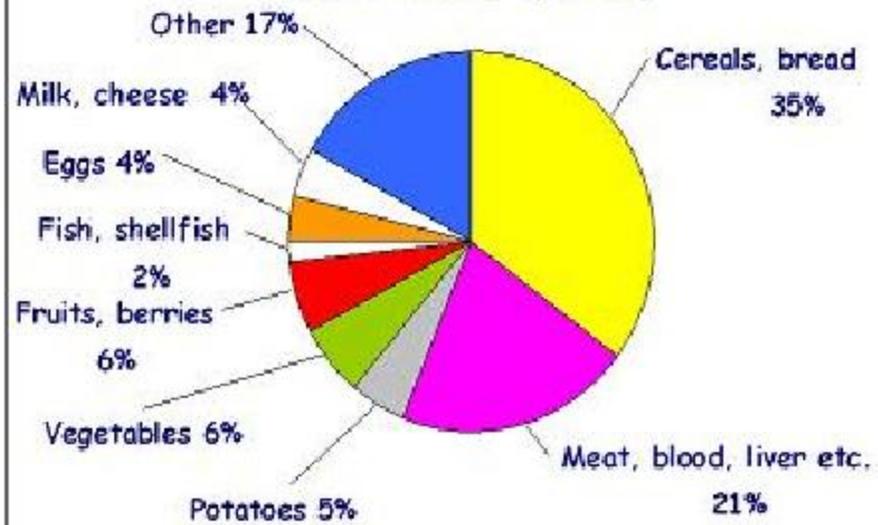
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MOST IMPORTANT IRON SOURCES IN NORWAY (2003)



| (2003)

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Table 4 (continued). Iron requirements and recommended iron intakes by age and gender group

Total absolute requirements* (median) (mg/day)	Recommended iron intakes to cover requirements of 97.5% of populations for diets of different bioavailability (mean + 2 SD) (mg/day)			
	Level of dietary iron bioavailability %			
	High 15%	Intermediate 12%	Low 10%	Very low 5%
0.72	6.2 ^c	7.7 ^c	9.3 ^c	18.6 ^c
0.46	3.9	4.8	5.8	11.6
0.50	4.2	5.3	6.3	12.6
0.71	5.9	7.4	8.9	17.8
1.17	9.7	12.2	14.6	29.2
1.50	12.5	15.7	18.8	37.6
1.05	9.1	11.4	13.7	27.4
1.20	9.3	11.7	14.0	28.0
1.68	21.8	27.7	32.7	65.4
1.62	20.7	25.8	31.0	62.0
1.46	19.6	24.5	29.4	58.8
0.87	7.5	9.4	11.3	22.6
1.15	10.0	12.5	15.0	30.0

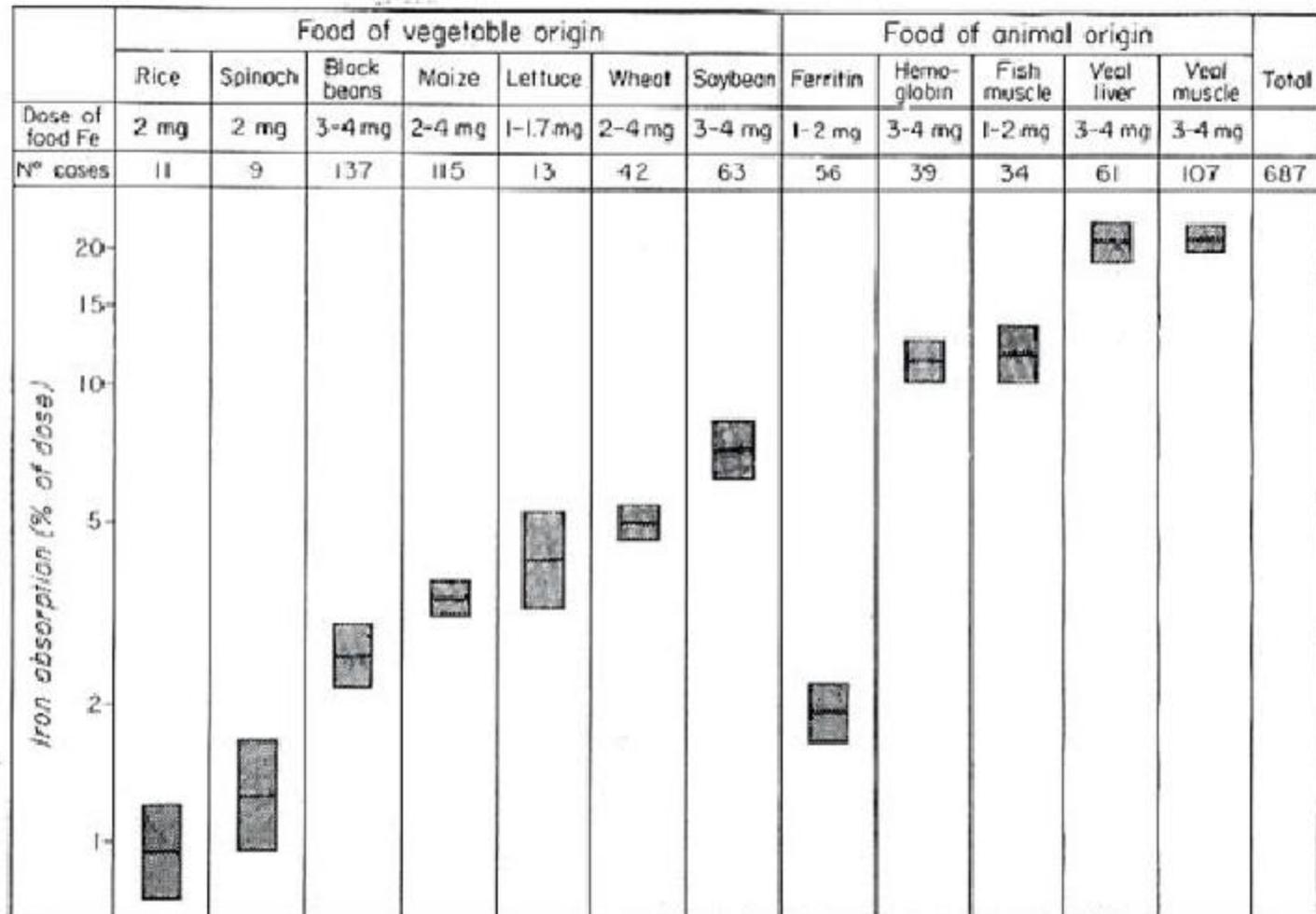
| (: FAO/WHO
2002)

Adapted from: Vitamin and mineral requirements in human nutrition, FAO/WHO (to be published)



3-15%

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Layrisse et al 1971, 1975



Таблица 4.5. Вещества, способствующие и препятствующие всасыванию железа

Способствуют	Препятствуют
Тёмное железо, присутствующее в мясе, птице, рыбе и морепродуктах	Фитаты, присутствующие в отрубях злаковых, зерна злаковых, мука высокого выхода, бобовые, орехи и семена
Аскорбиновая кислота или витамин С, присутствующие во фруктах, соках, картофеле и некоторых других клубнях, и другие овощи, такие, как зеленые листовые, цветная и обыкновенная капуста	Пищевые продукты с высоким содержанием инозита
Некоторые ферментированные или проросшие пищевые продукты и приправы, такие, как квашеная капуста и соевый соус*	Связывающие железо феноловые соединения (танины), пищевые продукты, содержащие наиболее сильнодействующие ингибиторы, стойкие к действию веществ, усиливающих всасывание (включая чай, кофе, какао, травяные настои, некоторые специи, такие, как душица, и некоторые овощи).
	Кальций, особенно в молоке и молочных продуктах

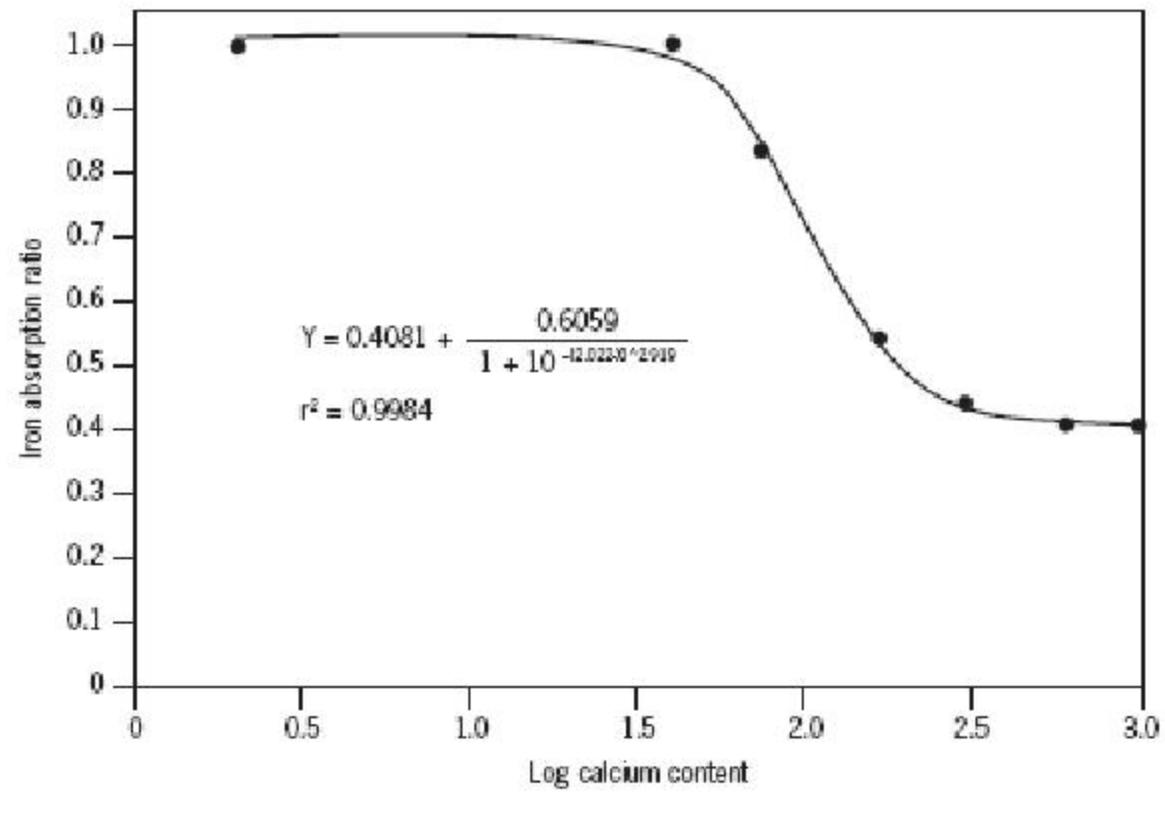
* Тепловая обработка, ферментация или проращивание уменьшают количество фитатов.
Источник: Michaelsen et al. (47).

Supplementation with additional vitamin C is not currently recommended without a liver biopsy, as ascorbate is believed to increase tissue damage due to transition metals, such as copper and iron

(: Sokol, R. J. Antioxidant defenses in metal induced liver damage. *Seminars in Liver Diseases* 1996; 16: 39–46.



FIGURE 13.3
Effect of different amounts of calcium on iron absorption



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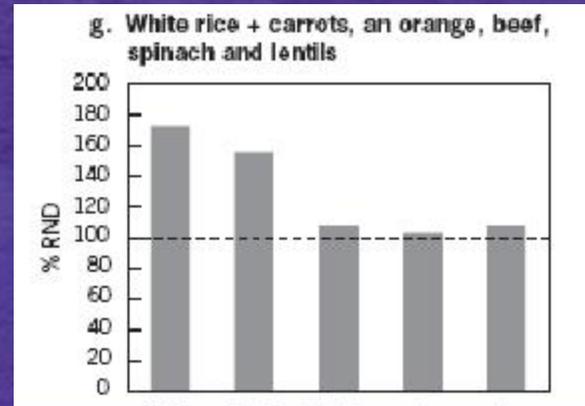
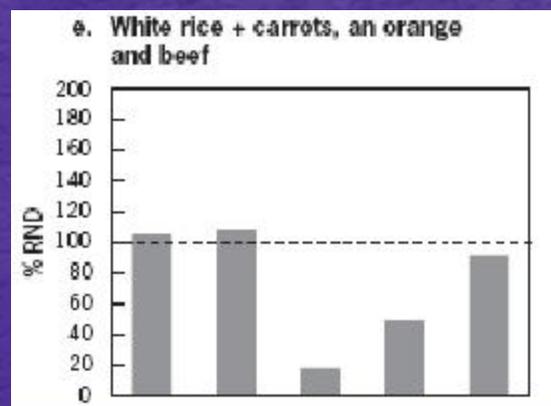
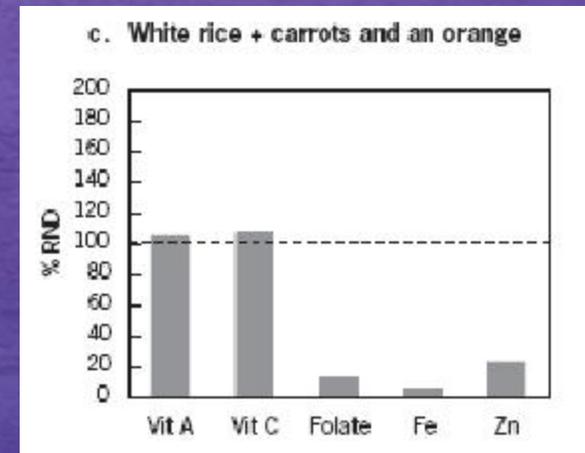
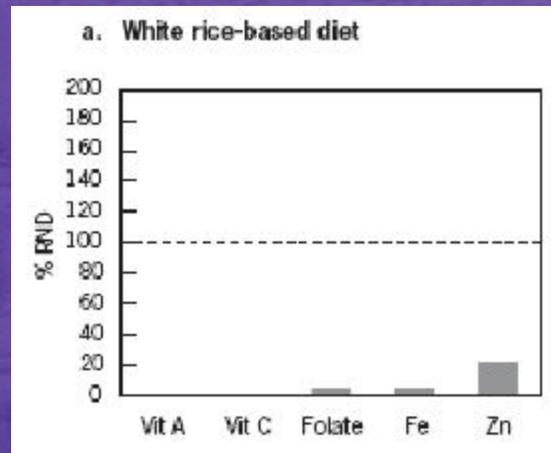
	Breast milk	Cow's milk
<i>Iron content</i>	low ~ 1.5 mg/L	low ~ 1 mg/L
<i>Iron absorption</i>	good*	poor [#]
<i>Iron loss</i>	very small	micro bleedings may occur
<i>Abs-enhancers</i>		
vit. C, mg/dL	3-8	1
taurin? mg/L	24-85	3-11
lactose? g/dL	7	4,3
<i>Abs-inhibitors</i>		
calcium? mg/dL	25	100
<i>Iron deficiency anaemia</i>	unusual	more usual

*McMillan et al, 1976 ~ 21%[#] ~ 14%

Saarinen et al, 1977 ~ 50% ~ 20%

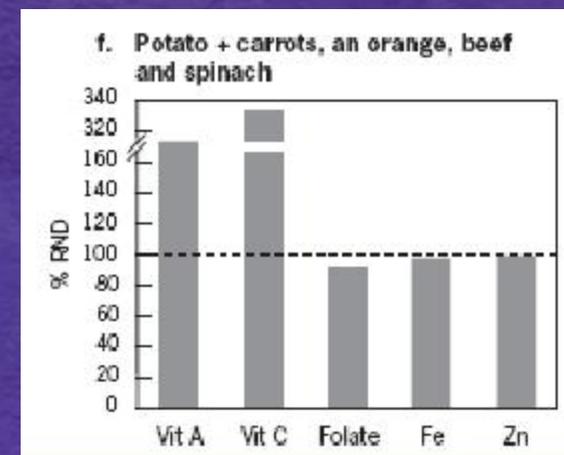
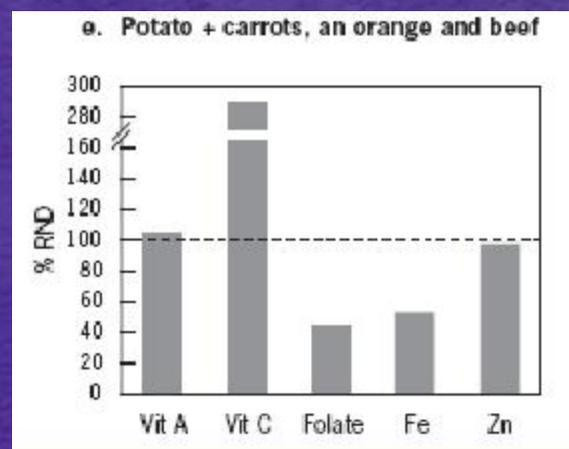
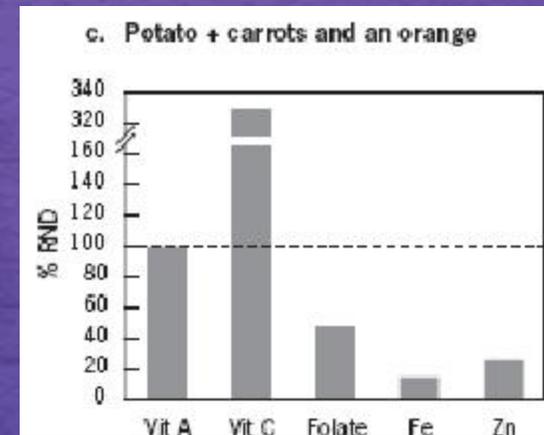
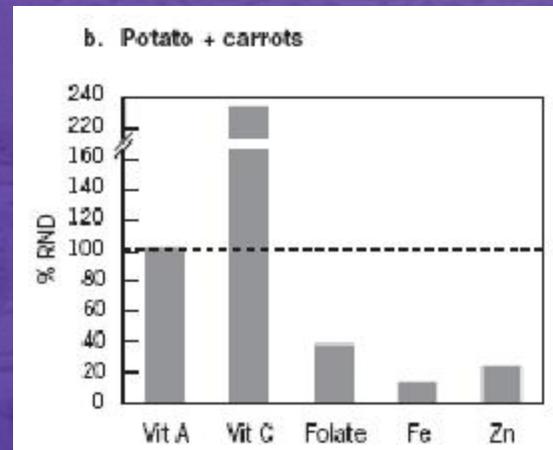
[#]Absorption from breast milk measured in adults

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Oyarzun MT, Uauy R, Olivares S. Food-based approaches to improve vitamin and mineral nutrition adequacy. *Archivos Latinoamericanos de Nutricion*(Guatemala), 2001, 51:7-18.

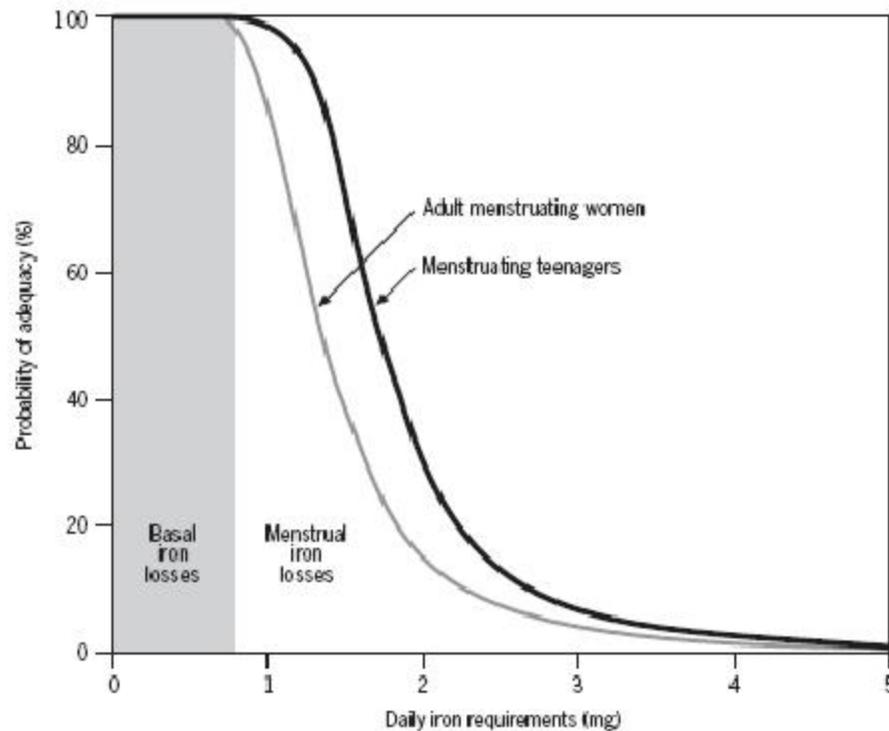
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Oyarzun MT, Uauy R, Olivares S. Food-based approaches to improve vitamin and mineral nutrition adequacy. *Archivos Latinoamericanos de Nutricion*(Guatemala), 2001, 51:7-18.



FIGURE 13.2
Distribution of daily iron requirements in menstruating adult women and teenagers: the probability of adequacy at different amounts of iron absorbed



The left-hand side of the graph shows the basal obligatory losses that amount to 0.8 mg/day. The right-hand side shows the variation in menstrual iron losses. This graph illustrates that growth requirements in teenagers vary considerably at different ages and between individuals.

(: IOM 2002)

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- 140-180

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119 /

26%,

120 / -

1,5%.

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Absorption of dietary iron (%)

Bioavailability / Meal	♀ Iron stores				♂ Iron stores			
	0 mg		250 mg		500 mg		1000 mg	
	N-H	H	N-H	H	N-H	H	N-H	H
<u>LOW</u>	5	35	4	28	3	23	2	15
<u>MEDIUM</u>	10	35	7	28	5	23	3	15
<u>HIGH</u>	20	35	12	28	8	23	4	15

N-H = *non-haem iron*; H = *haem iron*

LOW: < 30 g meat, poultry, fish, or <25 mg vit C

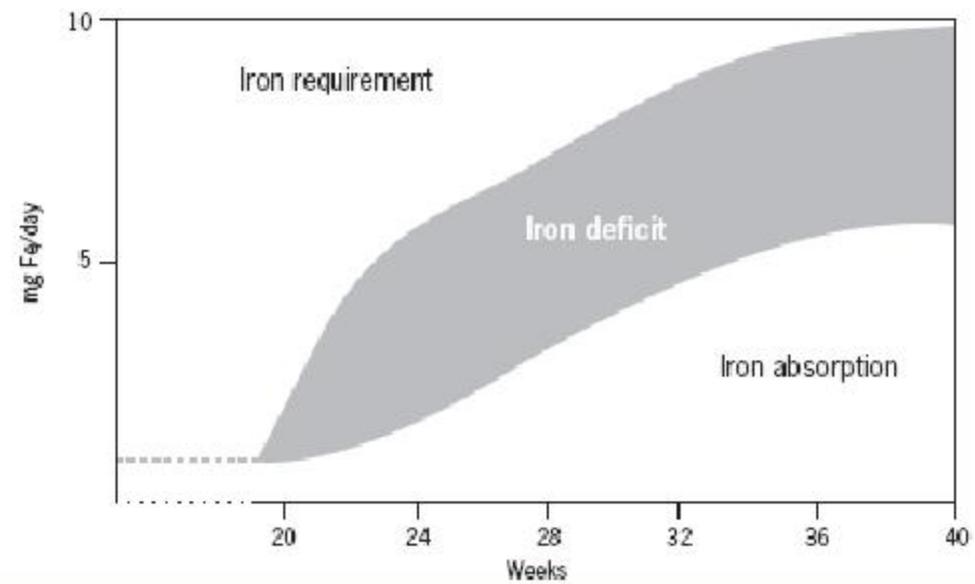
MEDIUM: 30-90 g meat, etc., or 25-75 mg vit C

HIGH: > 90 g meat, etc., or >75 mg vit C, or
30-90 g meat, etc., + 25-75 mg vit C

Source: Mosen ER et al. Am J Clin Nutr 1978;31:134-44.



FIGURE 13.5
Daily iron requirements and daily dietary iron absorption in pregnancy



2

37%

41-44%

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Table 5. Relative* and Attributable† Risks for Low Birth Weight and Preterm Delivery by Study Location and Anemia Severity⁷⁷

Location	Relative Risk Low Birth Weight	Relative Risk Preterm Delivery	Attributable Risk Low Birth Weight	Attributable Risk Preterm Delivery
Developed Countries				
Moderate anemia	1.4 (N = 2) (range 0.8–2.1)	1.5 (N = 8) (range 0.6–1.9)	53.0% (N = 1)	45.7% (N = 3) (range 23–67)
Severe anemia	4.6 (N = 3) (range 2.4–6.3)	1.7 (N = 3) (range 1.1–2.6)	71.5% (N = 2) (range 59–84)	32.7% (N = 3) (range 9–59)
Less-Developed Countries				
Moderate anemia	1.5 (N = 8) (range 0.8–3.0)	1.8 (N = 4) (range 0.6–2.6)	6.3% (N = 1)	N/A
Severe anemia	2.6 (N = 9) (range 1.4–5.0)	2.5 (N = 2) (range 1.0–4.0)	52.9% (N = 4) (range 42–83)	N/A

*Relative risk is “the probability of an event occurring in the active group divided by the probability of the event occurring in the control group.”

†Attributable risk is “the proportion of the events (in a specified time) in the whole population that may be preventable if a cause of the event were totally eliminated.”



Table 9. Proportion of anaemic pregnant women who responded to oral iron and vitamin A supplements and became non-anaemic

<i>Treatment</i>	<i>Number of subjects</i>	<i>Anaemic cases that responded (haemoglobin >110 g/l)</i>
Placebo	62	16%
Vitamin A only	63	35%
Iron only	63	68%
Iron and vitamin A	63	97%

Source: Suharno et al. (107)



TABLE 13.1

Iron intakes required for growth under the age of 18 years, median basal iron losses, menstrual losses in women, and total absolute iron requirements

Group	Age (years)	Mean body weight (kg)	Required iron intakes for growth (mg/day)	Median basal iron losses (mg/day)	Menstrual losses		Total absolute requirements ^a	
					Median (mg/day)	95th percentile (mg/day)	Median (mg/day)	95th percentile (mg/day)
Infants and children	0.5-1	9	0.55	0.17			0.72	0.93
	1-3	13	0.27	0.19			0.46	0.58
	4-6	19	0.23	0.27			0.50	0.63
	7-10	28	0.32	0.39			0.71	0.89
Males	11-14	45	0.55	0.62			1.17	1.46
	15-17	64	0.60	0.90			1.50	1.88
	18+	75		1.05			1.05	1.37
Females	11-14 ^b	46	0.55	0.65			1.20	1.40
	11-14	46	0.55	0.65	0.48 ^c	1.90 ^c	1.68	3.27
	15-17	56	0.35	0.79	0.48 ^c	1.90 ^c	1.62	3.10
	18+	62		0.87	0.48 ^c	1.90 ^c	1.46	2.94
Postmenopausal		62		0.87			0.87	1.13
Lactating		62		1.15			1.15	1.50

^a Total absolute requirements = Requirement for growth + basal losses + menstrual losses.

^b Pre-menarche.

^c Effect of the normal variation in haemoglobin concentration not included in this figure.

Source: adapted, in part, from reference (8) and in part on new calculations of the distribution of iron requirements in menstruating women.

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TABLE 13.5
The recommended nutrient intakes (RNIs) for iron for different dietary iron bioavailabilities (mg/day)

Group	Age (years)	Mean body weight (kg)	Recommended nutrient intake (mg/day) for a dietary iron bioavailability of			
			15%	12%	10%	5%
Infants and children	0.5-1	9	6.2 ^a	7.7 ^a	9.3 ^a	18.6 ^a
	1-3	13	3.9	4.8	5.8	11.6
	4-6	19	4.2	5.3	6.3	12.6
	7-10	28	5.9	7.4	8.9	17.8
Males	11-14	45	9.7	12.2	14.6	29.2
	15-17	64	12.5	15.7	18.8	37.6
	18+	75	9.1	11.4	13.7	27.4
Females	11-14 ^b	46	9.3	11.7	14.0	28.0
	11-14	46	21.8	27.7	32.7	65.4
	15-17	56	20.7	25.8	31.0	62.0
	18+	62	19.6	24.5	29.4	58.8
Postmenopausal		62	7.5	9.4	11.3	22.6
Lactating		62	10.0	12.5	15.0	30.0

^a Bioavailability of dietary iron during this period varies greatly.

^b Pre-menarche.

Source: adapted, in part, from reference (8) and in part on new calculations of the distribution of iron requirements in menstruating women. Because of the very skewed distribution of iron requirements in these women, dietary iron requirements are calculated for four levels of dietary iron bioavailability.



Рекомендуемая потребность железа (мг/день)

Группы	ВОЗ/ММА*				ЕС*	Словения Берга	Республика Федерация	Словения Королевства			Словения Штаты			
	15%	12%	10%	8%				FMHP	ICLP	MHP	ICSI	PCHP		
Общие	-	-	-	-	-	-	-	-	-	-	-			
Мужчины РСН						12	10			5,1				
Мужчины ПОП						8,5	-			-				
Мужчины минимум*						7	-			-				
Женщины РСН						12	18			14,6				
Женщины ПОП						13 (10)	-			-				
Женщины минимум*						10 (8)	-			-				
Дети по годам														
0-1 месяцев										0,0	1,3	1,7	0,27 [†]	-
1-6 месяцев										2,5	2,2	1,5	0,27 [†]	
7-12 месяцев	[9]	[9]	[9]	[10]	2					1,5	6,0	7,6	6,0	11,0
Дети старше 1 года														
1-3 года	4	5	6	12	4					3,7	5,3	5,9	3,0	7,3
4-6 лет	4	5	6	12	4					3,2	4,7	5,1	4,1	10,0
7-9 лет	6	7	9	16	5					4,7	6,7	5,1	4,1	10,0
Подростки														
Муж. подрост. 13-13 лет	18	12	16	26	10					6,1	8,7	11,4	6,0	8,3
Муж. подрост. 14-18 лет	12	16	19	36	13					6,1	8,7	11,4	7,7	11,0
Жен. подрост. 13-13 лет	11/22	12/23	14/33	21/35	18-22*					3,0	11,4	14,6*	5,7	8,3
Жен. подрост. 14-18 лет	2*	28	31	62	17-21*					3,0	11,4	14,6*	7,0	15,0

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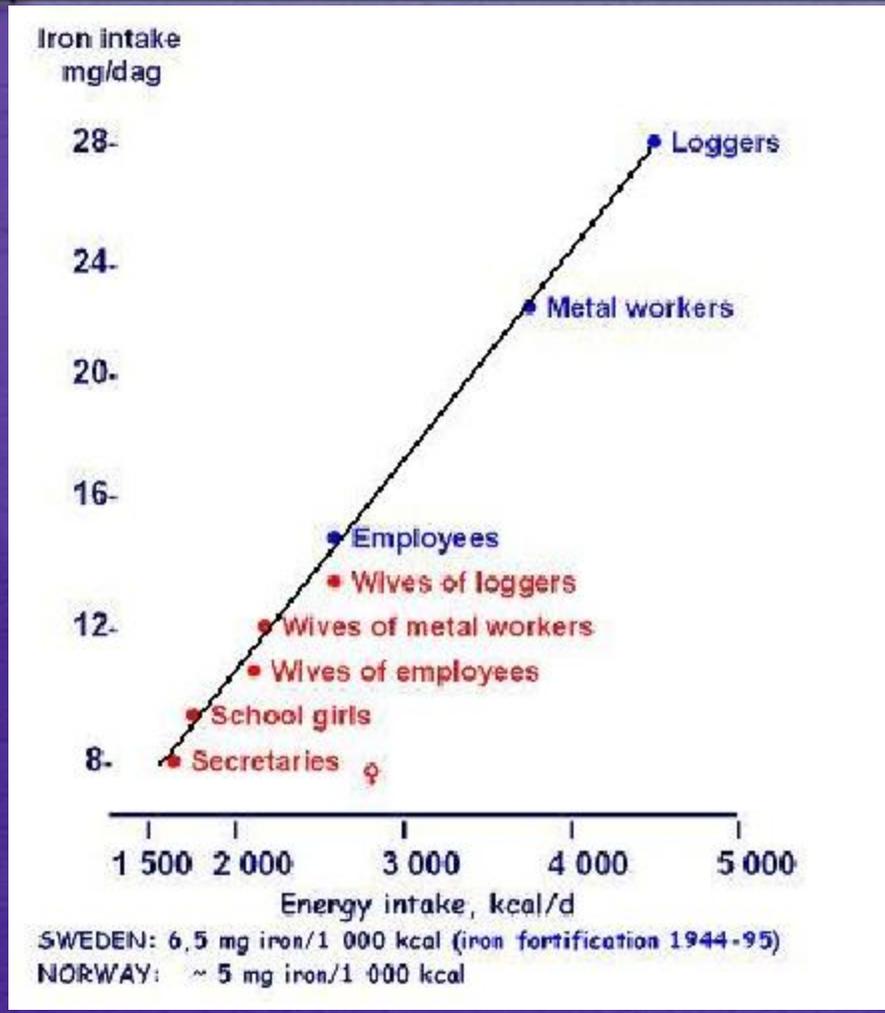
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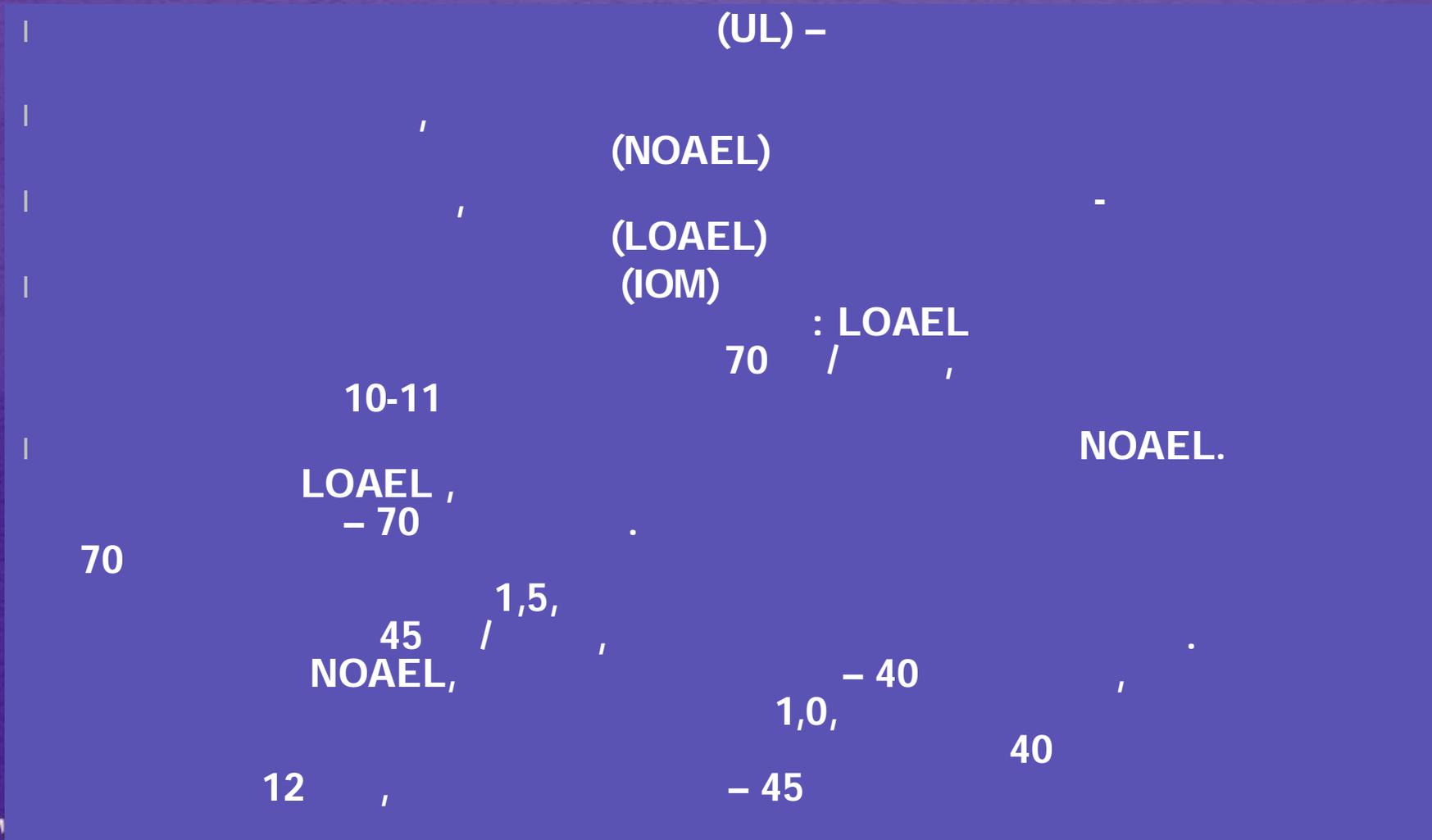
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- | *Children 2 years.*
- | Lethal dose (iron sulfate) 3 g
- | Severe poisonings 1 g
- | *Adults.*
- | Lethal dose 200-250 mg /kg BW
- | Number of cases in USA:
- | Ca. 2 000 per year
- | Number of cases in Norway 1991:
- | Children < 1 year - 0
- | Children 1 - 3 years - 16
- | Children 3 - 6 years - 7
- | Adults - 4



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