ERNÆRINGSFOKUSKONFERENCEN 2019

FØDEVAREMATRICER

- når fødevarer er mere end næringsstoffer

Fokus på jern og zink

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Zink og jern
- Hvorfor er det vigtigt?

Zink (Zn^{2+})
Atomnummer 30
Masse: 65,39 g/mol

Katalytisk, strukturel og regulatoriske funktioner

Katalytisk I 100-vis af enzyme
Strukturelt i f.eks foldning af zink-finger
Regulatorisk i f.eks genregulering

Jern (Fe^{2+} og Fe^{3+})
Atomnummer 26
Masse: 55,845 g/mol

Nødvendig for syntese af hæmoglobin, myoglobin, cytokromer, katalase, peroxidase

Hæm- og myoglobin: ilttransport
Cytokrom: elektrontransport og oxidative fosforylering
Peroxidaser: fagocytose og bekæmpelse af bakterier

Østers

Zn: 84 mg/100 g
Fe: 3 mg/100 g

Skinke

Zn: 1,7 mg/100 g
Fe: 0,7 mg/100 g

Kylling

Zn: 1 mg/100 g
Fe: 0,6 mg/100 g

Krabbe

Zn: 5,5 mg/100 g
Fe: 1,3 mg/100 g

Kikærter

Zn: 1 mg/100 g
Fe: 6,4 mg/100 g

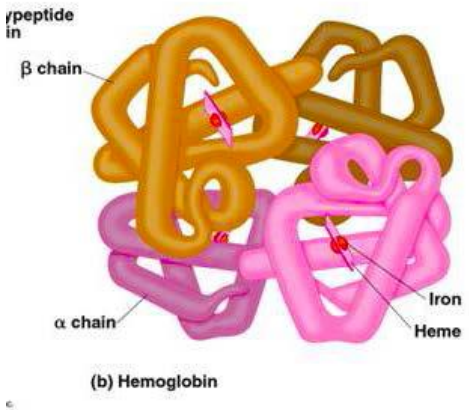
Steak

Zn: 3,4 mg/100 g
Fe: 1,7 mg/100 g

Broccoli

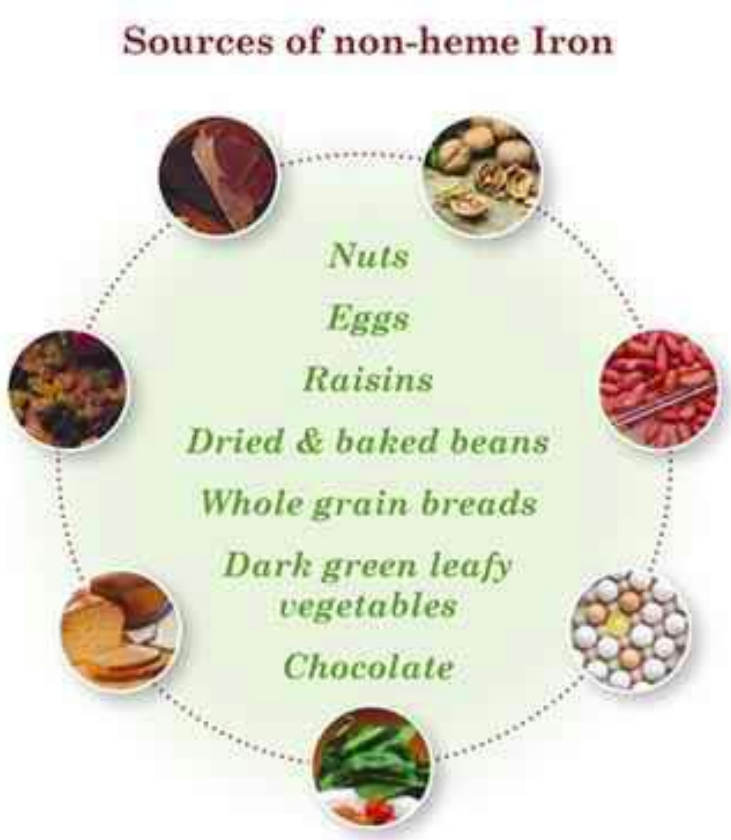
Zn: 0,4 mg/100 g
Fe: 0,7 mg/100 g

Kostens jern



Hæm jern

Non-hæm jern (Fe2+ and Fe3+)



Indtag:	**10-15%**	**85-90%**
Absorptions ratio:	**up to 25%**	**1-5%**

Faktorer af betydning for **biotilgængelighed**

Kostfaktorer – fødevarematricen og måltidssammensætning:

- **Indtagne mængde**
- **Kemisk form**
- **Andre kostfaktorer (fiber, fedt, protein, vitaminer, mineraler)**
- **Tilberedning**
- (Medicin)

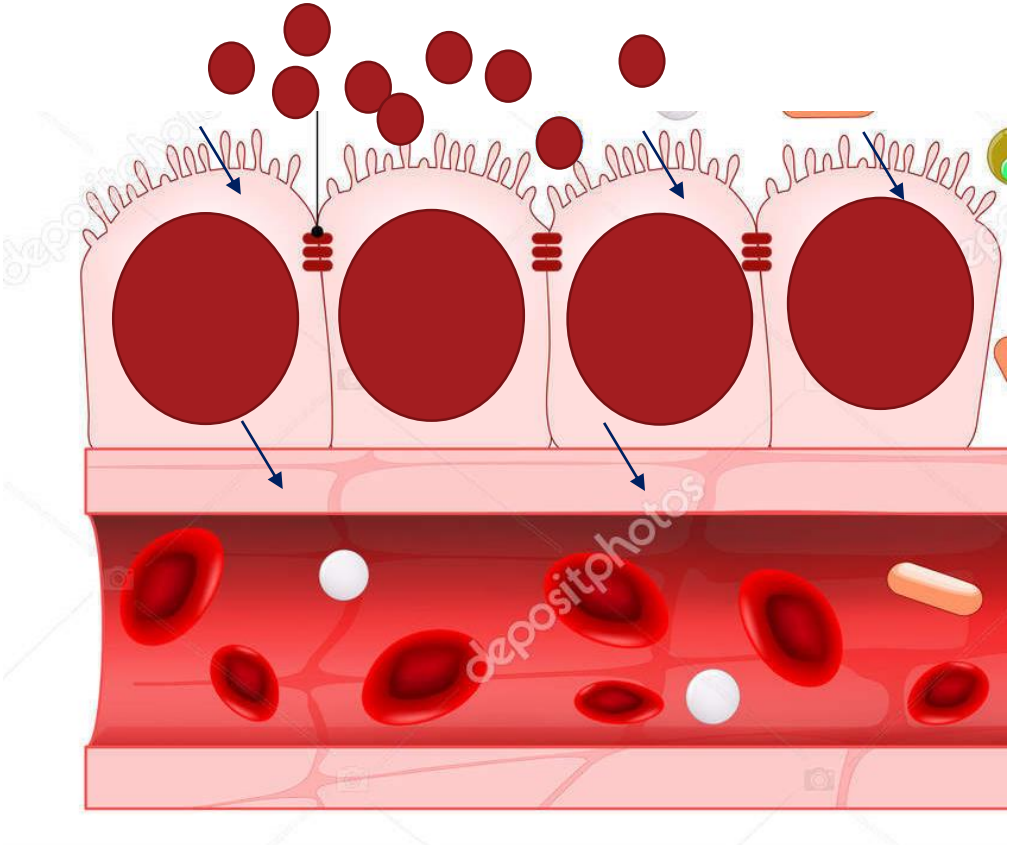
Værtsfaktorer:

- Ernæringsstatus
- Fysiologiske faktorer (vækst, graviditet mm)
- Patologisk status (sygdom)
- Kost og personlige vaner

Biotilgængelighed = Optagelse OG udnyttelse

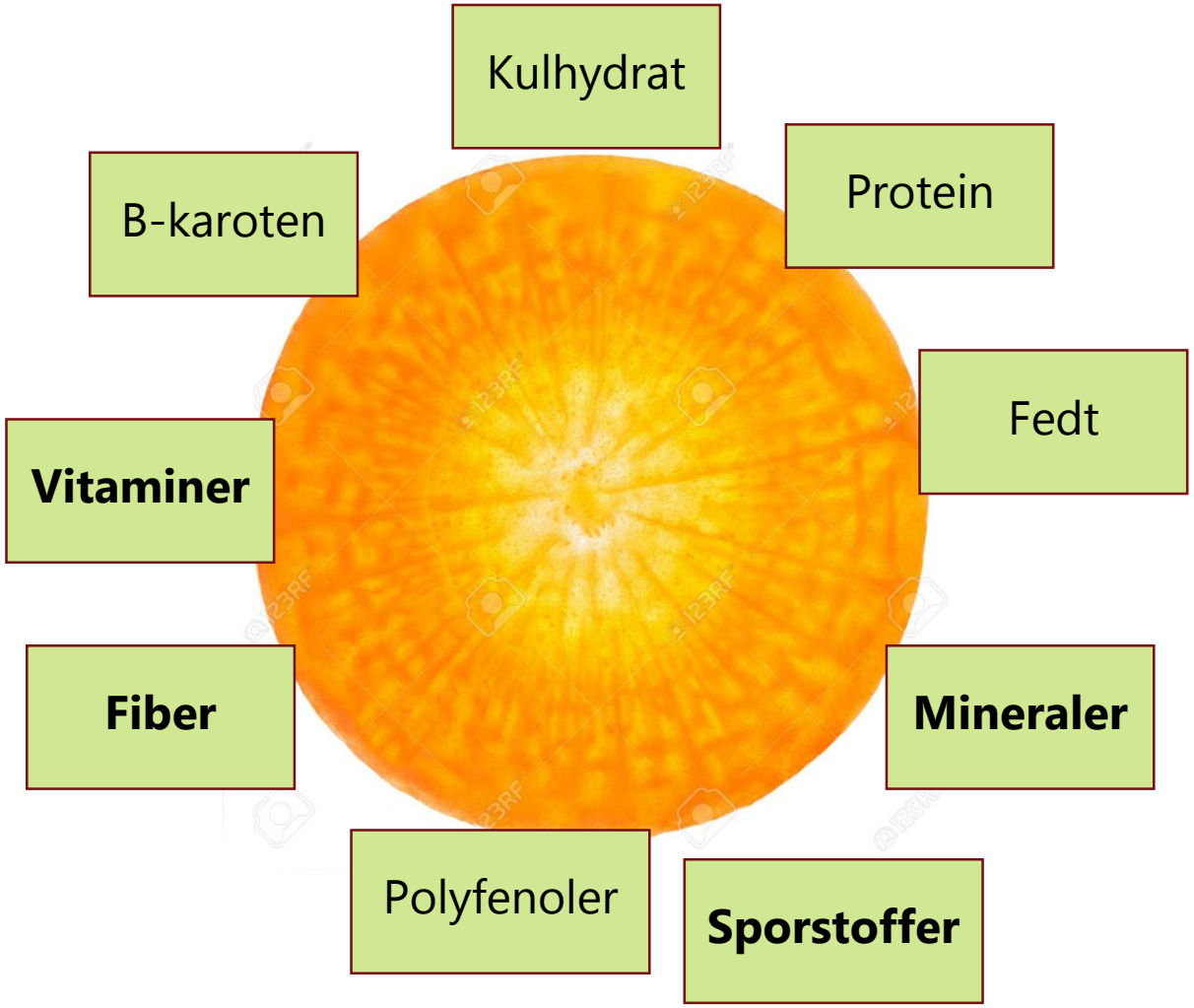
Jernoptag

Indtag af høje koncentrationer = mætter den aktive transport ind i cellen og øger koncentrationen af jern i tarmcellen = nedregulering af transportproteiner ind i blodbanen



Fødevarematrix

Vi spiser fødevarer, ikke næringsstoffer



Tilberedning af fødevarer

	Fordele	Ulemper
Varmebehandling	Protein denaturering, frigørelse af næringsstoffer fra fødevarematricen Reduktion af f.x fysinsyre	Udvaskning af labile næringsstoffer
Fermentering	Nedbrydning af fytinsyre, dannelse af lav-molekylære produkter	
Maling af korn, polering af ris mm	Fjerner fysinsyre	De fleste næringsstoffer fjernes

Factors affecting iron absorption

	NUTRIENTS	ENDOGENOUS FACTORS
Enhancers	Ascorbic acid (vitamin C)	Enhanced erythropoiesis due to
	Fructose	Hypoxia
	Citric acid	Hemorrhage
	Dietary protein	Hemolysis
	Lysine	Androgens
	Histidine	Cobalt
	Cysteine	Low iron stores
	Methionine	
Inhibitors	Oxalic acid	Infection/inflammation
	Tannins	Lack of stomach acid
	Phytate	High iron stores
	Polyphenols	
	Carbonate	
	Phosphate	
	Fiber	
	Other metal ions	

Kostfaktorer der påvirker zinks biotilgængelighed

Kostfaktor		
Fytinsyre	Hæmmer	
Kalcium	?	konfliktende
Folinsyre	-	Ingen rapporteret
Jern		Konfliktende, afhænger af jern og matrix
Tin og kobber	Tin hæmmer	
B6	Øger muligvis	
Vit C	Ingen påvist	
Protein	Hæmmes af nogle, men ikke andre.	**Kødprotein til et plantebaseret måltid øger absorptionen**
Mælk og yoghurt	øger	

J Nutr. 2006 Nov;136(11):2808-12.

Meat protein fractions enhance nonheme iron absorption in humans.

Hurrell RF[1], Reddy MB, Juillerat M, Cook JD.

Author information

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Abstract

The nature of the enhancing effect of muscle tissue on nonheme iron absorption in humans is unclear but thought to be related to muscle proteins. We conducted radioiron absorption studies to compare iron absorption from proteins isolated from beef and chicken muscle with that from freeze-dried beef and chicken muscle and from egg albumin. All meals contained an equivalent amount of protein as part of a semisynthetic liquid formula. Freeze-dried beef and chicken muscle increased iron absorption 180% ($P < 0.001$) and 100% ($P < 0.001$), respectively, relative to egg albumin. When added to the meal at an equivalent protein level (15 g), the isolated beef protein and the isolated heme-free beef protein with 94 and 98% protein content, respectively, increased iron absorption to the same extent as the native beef muscle. Similarly, when added to the meal at an equivalent protein level (30 g), isolated chicken muscle protein (94% protein) increased iron absorption similarly to native chicken muscle. Iron absorption from the meal containing the isolated heme-free chicken protein, however, was 120% ($P < 0.01$) greater than from the meal containing f
with iron-binding potential may have been removed or c
the hypothesis that the enhancing effect of muscle tissu
play a role.

Pediatr Res. 1998 Jun;43(6):768-73.

The influence of meat on nonheme iron absorption in infants.

Engelmann MD[1], Davidsson L, Sandström B, Walczyk T, Hurrell RF, Michaelsen KF.

Author information

1 Research Department of Human Nutrition, LMC Centre for Advanced Food Studies, The Royal Veterinary and Agricultural University, Frederiksberg, Denmark.

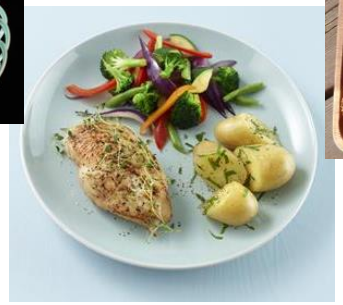
Abstract

During weaning the infant has a high iron requirement, and highly available dietary iron is needed to ensure optimal iron status. Muscle tissue has been identified as an enhancer of nonheme iron absorption in adults, although the influence of meat on nonheme iron absorption in infants has not been previously reported. The effect of the addition of 25 g of meat (lean beef) on nonheme iron absorption from a home-prepared vegetable purée meal (80 g of vegetables) was investigated in infants in the present study. The meals did not differ in their contents of other known enhancers or inhibitors of nonheme iron absorption. Incorporation of stable isotopes of iron (57Fe and 58Fe) into red blood cells 14 d after intake was used to measure iron absorption, using a cross-over design in eight healthy infants 43-49 wk of age. Nonheme iron absorption was significantly increased ($p = 0.002$) from the vegetable purée with added meat (geometric mean 15.0%) compared with the puréed vegetables (geometric mean 9.9%). These results thus suggest that meat is also an enhancer of nonheme iron absorption in infants and that nonheme iron absorption from weaning foods can be increased by the addition of meat.

Zink absorption hos 12 unge mænd der indtager henholdsvis en kødbaseret lav fiber og en tilsvarende diæt + havreklid i 3 uger.

Nutrient	low fiber	+oat bran
Na, g *(mmol)*	3.5 (152)	3.4 (148)
K, g *(mmol)*	3.3 (84)	4.2 (107)
Ca, mg *(mmol)*	738 (18)	817 (20)
Mg, mg *(mmol)*	249 (10)	505 (21)
P, g *(mmol)*	1.1 (36)	1.8 (58)
Fe, mg *(µmol)*	5.2 (93)	11.6 (208)
Zn, mg *(µmol)*[1]	9.0 (138)	14.7 (225)
Cu, mg *(µmol)*	1.1 (17)	1.8 (28)
Phytate, *mmol*	0.5	4.0

Sandström, Bügel et al., 2000


	Zinc
	µmol/d
Dietary intake	
Low-fiber	151 ± 28
Oat bran	253 ± 50*
Fecal excretion[2]	
Low-fiber	163 ± 62
Oat bran	289 ± 50*
Apparent absorption	
Low-fiber	−27 ± 38
Oat bran	−36 ± 49

	Zinc
	µmol/d
Balance[3]	
Low-fiber	−33 ± 37
Oat bran	−42 ± 49
True absorption[4]	
Low-fiber	65 ± 24
Oat bran	103 ± 20*
Endogenous excretion[5]	
Low-fiber	98 ± 34
Oat bran	139 ± 43*

Sandström, Bügel et al., 2000

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Fødevarematrix

Fødevarematricen har betydning for tilgængeligheden af jern og zink

Kosten indeholder både komponenter der øger og hæmmer tilgængeligheden af jern og zink

Jern og zink tilgængeligheden fra plantebaseret kost kan øges ved behandling af fødevaren som sænker fytinsyreindholdet

Små mængder kød til en ellers plantebaseret kost kan øge biotilgængeligheden af jern og zink