
WBC Clinical Studies at Dept. of Clinical Physiology and Nuclear Medicine - Rigshospitalet - Copenhagen

- Intestinal absorption
- Nutritional studies in healthy persons
- Ca-47
- Fe-59
- Zn-65

Calcium absorption from small soft-boned fish.

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Abstract

The prevalence of osteoporosis in developing countries is low compared to most industrialised countries despite an apparent low Ca intake. It is possible, however, that food surveys have overlooked important Ca sources in developing countries. Small fish eaten with the bones can be a rich source of Ca, even though Ca from bone may be considered unavailable for absorption. In the present study, absorption of Ca from indigenous Bengali small fish was compared with the Ca absorption from milk. Ca absorption from single meals was determined in 19 healthy men and women (21-28 y). Each subject received two meal types on two separate occasions. Both meals consisted of white wheat bread, butter and ultra pure water with the main Ca source being either small Bengali fish (397 mg Ca in total) or skimmed milk (377 mg Ca in total). The meals were extrinsically labelled with ^{47}Ca , and whole-body retention was measured on day 8, 12, 15 and 19 after intake of each meal. The labelling procedure was evaluated by an in vitro method. The calculated absorption of Ca as measured with ^{47}Ca whole-body retention was $23.8 \pm 5.6\%$ from the fish meal and $21.8 \pm 6.1\%$ from the milk meal (mean \pm SD), which was not significantly different ($p = 0.52$). Even after correction for an incomplete isotope exchange, as indicated by the in vitro study, Ca absorption was similar from the two meal types. It was concluded that Ca absorption from small Bengali fish was comparable that from skimmed milk, and that these fish may represent a good source of Ca.

- Intestinal Ca absorption from milk and fish
- Meals labeled with Ca-47
- Whole body retention of Ca-47 – 8, 12, 15 and 19 days after meal

Green tea or rosemary extract added to foods reduces nonheme-iron absorption¹⁻³

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ABSTRACT

Background: Phenolic compounds act as food antioxidants. One of the postulated mechanisms of action is chelation of prooxidant metals, such as iron. Although the antioxidative effect is desirable, this mechanism may impair the utilization of dietary iron.

Objective: We sought to determine the effect of phenolic-rich extracts obtained from green tea or rosemary on nonheme-iron absorption.

Design: Young women aged 19–39 y consumed test meals on 4 separate occasions. The meals were identical except for the absence (meal A) or presence (meal B) of a phenolic-rich extract from green tea (study 1; $n = 10$) or rosemary (study 2; $n = 14$). The extracts (0.1 mmol) were added to the meat component of the test meals. The meals were extrinsically labeled with either ^{55}Fe or ^{59}Fe and were consumed on 4 consecutive days in the order ABBA or BAAB. Iron absorption was determined by measuring whole-body retention of ^{59}Fe and the ratio of ^{55}Fe to ^{59}Fe activity in blood samples.

Results: The presence of the phenolic-rich extracts resulted in decreased nonheme-iron absorption. Mean (\pm SD) iron absorption decreased from $12.1 \pm 4.5\%$ to $8.9 \pm 5.2\%$ ($P < 0.01$) in the presence of green tea extract and from $7.5 \pm 4.0\%$ to $6.4 \pm 4.7\%$ ($P < 0.05$) in the presence of rosemary extract.

Conclusion: Phenolic-rich extracts used as antioxidants in foods reduce the utilization of dietary iron. *Am J Clin Nutr* 2001; 73:607–12.

- Phenolic compound effects on intestinal iron absorption
- Meals labeled with Fe-59
- Whole body retention of Fe-59 - 2 wks after meals
- ^{59}Fe whole-body retention was measured in a leadlined steel chamber with 4 NE110 plastic scintillator blocks (Nuclear Enterprises Limited, Edinburgh) connected to conventional nuclear electronic modules and a multichannel analyzer system. The counting efficiency and energy window settings were established through measurements of water-filled phantoms whose outlines and weights are approximately equal to those of humans.

Folic acid enrichment of bread does not appear to affect zinc absorption in young women¹⁻³

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ABSTRACT

Background: In several countries cereals are now enriched with folic acid to reduce the risk of neural tube defects. Human studies suggest that folic acid interferes with zinc absorption. This raises concerns about the zinc status of high-risk groups such as infants, pregnant women, and older persons.

Objective: We sought to determine the effect of added folic acid on zinc absorption from white bread with high and low zinc contents.

Design: Zinc absorption was measured in 15 healthy women (22–33 y), each of whom consumed 4 single meals spaced 2 wk apart in a randomized crossover design. The servings of bread (100 g) differed in zinc and folic acid contents as follows: A, 1.2 mg Zn and 17 µg folic acid; B, 1.2 mg Zn and 144 µg folic acid; C, 3.0 mg Zn and 17 µg folic acid; and D, 2.9 mg Zn and 144 µg folic acid. Meals were extrinsically labeled with ⁶⁵Zn and absorption was estimated from whole-body retention measurements. Folate status was assessed by measuring plasma and erythrocyte folate and plasma homocysteine concentrations.

Results: Mean (±SD) zinc absorption did not differ significantly in relation to the folate content of the breads at either the low zinc content (38.8 ± 13.5% and 40.6 ± 16.5% for A and B, respectively; *P* = 0.74) or the high zinc content (26.7 ± 9.3% and 22.7 ± 6.6% for C and D, respectively; *P* = 0.16). There was no significant correlation between folate status and zinc absorption (*r* < 0.3, *P* > 0.1).

Conclusion: Fortification of white bread with a commonly used amount of folic acid did not appear to influence zinc absorption at either a high or a low zinc content. *Am J Clin Nutr* 2001; 74:125–9.

- Folic acid effects on intestinal zinc absorption
- Meals labeled with Zn-65
- Whole body retention of Zn-65 (>80 keV) 12 days after meals. Plastic scintillator blocks.

Nonheme-iron absorption from a phytate-rich meal is increased by the addition of small amounts of pork meat¹⁻⁴

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ABSTRACT

Background: Muscle tissue from various sources is known to promote nonheme-iron absorption. However, systematic studies of the dose dependency of this effect of meat on iron absorption from an inhibitory meal with low amounts of meat are lacking.

Objective: We investigated the dose-response effect of small amounts of meat on nonheme-iron absorption from a meal presumed to have low iron bioavailability.

Design: Forty-five healthy women with a mean (\pm SD) age of 24 ± 3 y were randomly assigned to 1 of 3 groups, each of which was served (A) a basic meal (rice, tomato sauce, pea purée, and a wheat roll) and (B) the basic meal with either 25, 50, or 75 g pork (longissimus muscle). Meal A contained 2.3 mg nonheme iron, 7.4 mg vitamin C, and 220 mg (358 μ mol) phytate. Each meal was served twice, and the order of the meals was ABBA or BAAB. The meals were extrinsically labeled with ⁵⁵Fe or ⁵⁹Fe. Iron absorption was determined from measurements of ⁵⁹Fe whole-body retention and the activity of ⁵⁵Fe and ⁵⁹Fe in blood samples.

Results: Twenty-five grams meat did not increase nonheme-iron absorption significantly ($P = 0.13$), whereas absorption increased 44% ($P < 0.001$) and 57% ($P < 0.001$), respectively, when 50 and 75 g meat were added to the basic meal. In absolute values, this corresponds to an absorption that was 2.6% and 3.4% higher, respectively, than that with the basic meal after adjustment of the data to a level of 40% absorption from a reference dose.

Conclusion: Small amounts of meat (≥ 50 g) significantly increase nonheme-iron absorption from a phytate-rich meal low in vitamin C. *Am J Clin Nutr* 2003;77:173-9.

- Meat effects on intestinal iron absorption
- Meals labeled with Fe-59
- Whole body retention of Fe-59 - 17 days after meals.

Increasing the Cooking Temperature of Meat Does Not Affect Nonheme Iron Absorption from a Phytate-Rich Meal in Women¹

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ABSTRACT The effect of increasing cooking temperatures of meat on nonheme iron absorption from a composite meal was investigated. Cysteine-containing peptides may have a role in the iron absorption enhancing effect of muscle proteins. Heat treatment can change the content of sulfhydryl groups produced from cysteine and thereby affect iron absorption. Twenty-one women (25 ± 3 y) were served a basic meal without meat and two other meals consisting of the basic meal plus 75 g of pork meat cooked at 70, 95 or 120°C. The meals were extrinsically labeled with ⁵⁵Fe or ⁵⁹Fe. Iron absorption was determined from measurements of whole-body ⁵⁹Fe retention and the activity of ⁵⁵Fe and ⁵⁹Fe in blood samples. Nonheme iron absorptions were 0.9 (0.5–4.0)% ($P = 0.06$), 0.7 (0.4–3.9)% ($P = 0.1$) and 2.0 (1.3–3.1)% ($P < 0.001$) greater when meat cooked at 70, 95 or 120°C, respectively, was added to the basic meal. Increasing the cooking temperature of meat did not impair nonheme iron absorption compared with cooking at 70°C. Because the cysteine content of meat decreased with increasing cooking temperature, this argues against a specific contribution of sulfhydryl groups from cysteine residues in the promotion of nonheme iron absorption by meat proteins. *J. Nutr.* 133: 94–97, 2003.

- Meat cooking temperature effects on intestinal iron absorption
- Meals labeled with Fe-59
- Whole body retention of Fe-59

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Pork meat increases iron absorption from a 5-day fully controlled diet when compared to a vegetarian diet with similar vitamin C and phytic acid content.

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Abstract

Meat increases absorption of non-haem iron in single-meal studies. The aim of the present study was to investigate, over a 5 d period, the potential increasing effect of consumption of pork meat in a whole diet on the fractional absorption of non-haem iron and the total absorption of iron, when compared to a vegetarian diet. A randomised cross-over design with 3 x 5 d whole-diet periods with diets containing Danish-produced meat, Polish-produced meat or a vegetarian diet was conducted. Nineteen healthy female subjects completed the study. All main meals in the meat diets contained 60 g of pork meat and all diets had high phytic acid content (1250 $\mu\text{mol/d}$). All main meals were extrinsically labelled with the radioactive isotope (^{59}Fe) and absorption of iron was measured in a whole body counter. The non-haem iron absorption from the Danish meat diet was significantly higher compared to the vegetarian diet ($P=0.031$). The mean fractional absorption of non-haem iron was 7.9 (se 1.1), 6.8 (se 1.0) and 5.3 (se 0.6) % for the Danish and Polish meat diets and vegetarian diet, respectively. Total absorption of iron was higher for both meat diets compared to the vegetarian diet (Danish meat diet: $P=0.006$, Polish meat diet: $P=0.003$). The absorption ratios of the present study were well in accordance with absorption ratios estimated using algorithms on iron bioavailability. Neither the meat diets nor the vegetarian diets fulfilled the estimated daily requirements of absorbed iron in spite of a meat intake of 180 g/d in the meat diets.

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The End
Thank you



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- Fe-59: **1099** (57%), **1292** (43%) keV
- Zn-65: **1116** (51%) keV
- Ca-47: **1297** (71%) keV

- K-40: **1461** (11%) keV
- Lu-177: **208** (11%), **113** (6%) keV