Dairy products: Facts & fantasy

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European Milk Forum

CERIN

MEN'S JOURNAL

GEAR HEALTH & FITNESS ADVENTURE FOOD & DRINK MORE

HEALTH & FITNESS

The Right Amount of Calcium

By Melaina Juntti

March 2, 2017

THE HUFFINGTON POST

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Milk Strong Bones

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Milk: Health benefits and nutritional infor

Written by Megan Ware RDN LD

Reviewed by Debra Rose Wilson, PhD, MSN, RN, IBCLC, AHN-BC, CHT

Last updated: Thu 23 February 2017

Cow's milk has long been associated with good health, making it one of the most consumed beverages throughout the United States and Europe.

Milk is a white liquid produced by the mammary glands of mammals. All mammals, including humans, will normally produce milk to feed their offspring until they are ready for solid food.

It contains valuable nutrients, and it can offer a range of health benefits. Calcium, for example, can prevent osteoporosis.

However, some people are not able to digest lactose, the sugar in milk, after

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Milk for healthy bones

The Case for Milk and Dairy

The USDA's recommendations are based on the fact that milk is a prime source hree important nutrients: calcium, potassium, and vitamin D (which is added to f nilk.)

Milk contains a big package of nutrients that are especially imp says Connie M. Weaver, PhD, who directs the nutrition departm People who don't drink milk tend to be deficient in them. So it r encourage people to consume dairy products."

Milk is also a good source of potassium -- another compelling r ecommended servings from two to th RD, professor of nutrition at Pennsyl ee.

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Replacing animal fat in diet may not reduce heart risk, says study

Switching from saturated to unsaturated fats helped lower cholesterol but did not reduce the prospect of heart attacks

THE IRISH TIMES

Wed, Mar 1, 2017

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Milk is having a moment

Is Irish butter and milk going to storm the supermarkets of the world and confound tl standard nutritional advice that butter and dairy aren't good for us?

Tue, Jan 31, 2017, 01:00

John McKenna

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WELL | EAT

When Choosing Cheese, Low-Fat May Not Matter

Ask The Experts: Is Milk Good fo

*There aren't many other single foods that come close to the nutrients you get from one cup of milk.
– Toby Amidor, MS, RD*

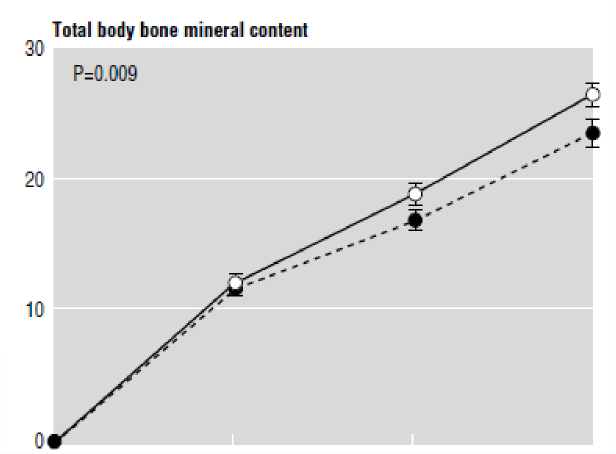
Absolutely! Milk is a nutrient-packed food providing nine essential nutrients in every glass, including calcium, potassium, and vitamin D. These are three of four nutrients that the 2015 Dietary Guidelines Advisory Committee report identified as under-consumed nutrients. There aren't many other single foods that come close to the nutrients you get from one cup of milk. The 2010 Dietary Guidelines for Americans recommended three daily servings of milk or dairy products for ages 9 years and older. These guidelines also noted moderate evidence showing that drinking milk and

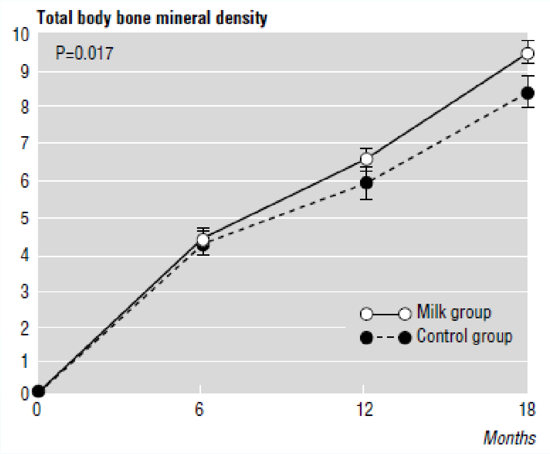
Facts

- Dairy products and bone health
- Dairy products and sarcopenia

Dairy products and growth

Open randomized intervention trial
80 girls, 12 years
Intervention: + 300 ml milk vs usual intake





- Greater increase of BMC and BMD
- No difference in height, weight, lean body mass, and fat mass

Cadogan J et al BMJ 1997

Dairy products and growth

The National Osteoporosis Foundation's position statement on peak bone mass development and lifestyle factors : A systematic review and implementation recommendations

"The evidence since 2000 builds on earlier evidence, with additional RCTs showing a benefit to bone owing to the inclusion of dairy products in the diet. Dairy products contain colloidal calcium phosphate protein complexes in the form of casein micelles that have the minerals and nutrients needed for bone growth."

Table 17 Recommended and actual intakes and functions of food sources involved in development of peak bone mass

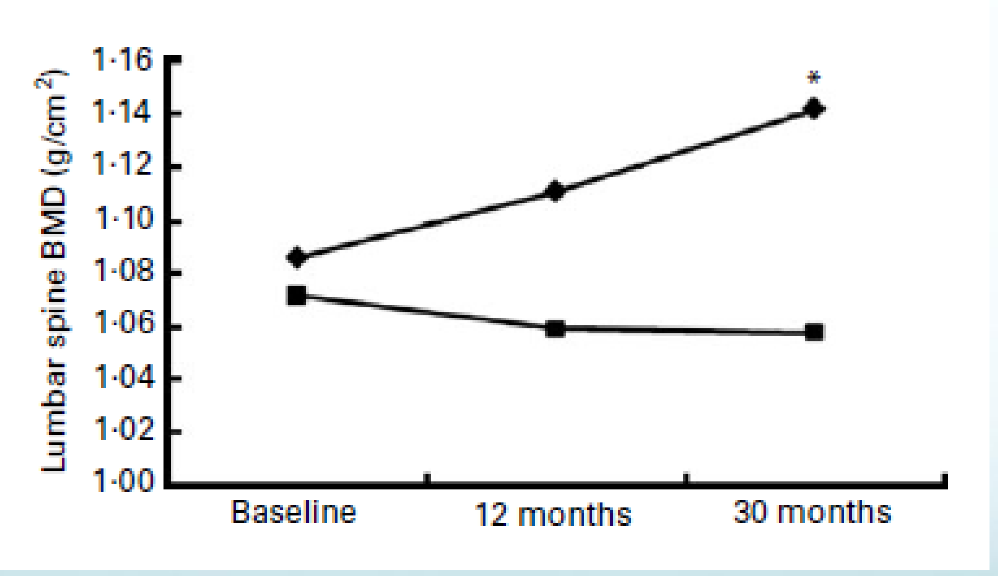
Food source	Bone-related function	Recommended servings[a]			Percentage of population with usual intakes below recommendations		
		Children	Males	Females	Children	Males	Females
Dairy (cups)[b]	Intakes correlated with linear growth, bone mass accrual, reduced fracture	2–3 years: 2 4–8 years: 2.5	9–13 years: 3 14–18 years: 3 19–30 years: 3	9–13 years: 3 14–18 years: 3 19–30 years: 3	2–3 years: 41 4–8 years: 42	9–13 years: 8 14–18 years: 68 19–30 years: 80	9–13 years: 84 14–18 years: 92 19–30 years: 94

Weaver CM et al. Osteopros Int 2016

Dairy products and BMD

The Postmenopausal Health Study : 66 women, 55-65 years, 30 months

- **intervention (n=35):** fortified dairy products (1200mg Ca + 300 IU vit D for 12 months, 1200mg Ca + 900 IU vit D for the next 18 months)
- **no intervention (n=31)**



*p<0.001

Moschonis G et al. Br J Nutr 2010

Dairy products and bone metabolism markers

The Postmenopausal Health Study : 101 women, 55-65 years, 12 months

- **dairy intervention group (n=39)**: fortified dairy products (1200mg Ca + 300 IU vitD/d
- **calcium supplemented group (*n*=26)** :1200 mg Ca/d
- **control group (*n* =36)**.

	Baseline	5 mo	5-mo change	12 mo	12-mo change	P^2
			%		%	
Serum IGF-1 (ng/mL)						0.019
Control group	112.9 ± 7.5[3]	117.3 ± 6.4[a]	5.8 (−0.9, 12.1)[4]	147.2 ± 9.5	28.2 (13.6, 42.8)	
Calcium-supplemented group	95.7 ± 13.6	95.2 ± 13.3[a]	−0.5 (−10.8, 9.8)	119.8 ± 17.1	27.6 (12.7, 42.4)	
Dairy intervention group	117.6 ± 7.3	132.8 ± 7.2[b]	15.9 (7.2, 24.6)	159.2 ± 9.2	38.5 (28.7, 48.3)	
P (treatment effect)	0.380	0.034		0.140		
Serum 25(OH)D (ng/mL)						0.050
Control group	25.5 ± 1.5	22.3 ± 1.3	−12.2 (−16.2, −8.2)	31.8 ± 1.8	24.4 (17.9, 30.8)	
Calcium-supplemented group	25.1 ± 2.6	20.5 ± 2.4	−16.2 (−24.2, −8.3)	30.0 ± 3.3	20.2 (10.2, 30.1)	
Dairy intervention group	28.1 ± 1.4	25.7 ± 1.3	−8.3 (−11.9, −4.8)	35.7 ± 1.8	30.1 (22.7, 37.6)	
P (treatment effect)	0.385	0.080		0.199		
Serum PTH (pg/mL)						0.035
Control group	35.6 ± 2.7	44.7 ± 2.9[a]	24.7 (13.6, 35.8)	42.3 ± 2.2	20.1 (11.3, 28.9)	
Calcium-supplemented group	35.8 ± 4.9	37.2 ± 5.2[a]	6.8 (−9.5, 23.1)	38.2 ± 4.1	6.8 (−9.4, 22.9)	
Dairy intervention group	31.6 ± 2.6	32.2 ± 2.8[b]	2.1 (−10.5, 14.7)	35.1 ± 2.2	11.1 (−3.0, 25.2)	
P (treatment effect)	0.545	0.010		0.142		
Serum osteocalcin (ng/mL)						0.563
Control group	4.50 ± 0.28	4.16 ± 0.28	−5.9 (−15.4, 3.6)	2.99 ± 0.31	−29.0 (−43.9, −14.2)	
Calcium-supplemented group	4.41 ± 0.50	4.21 ± 0.51	−1.0 (−23.1, 21.2)	3.52 ± 0.56	−17.1 (−40.0, 5.7)	
Dairy intervention group	4.55 ± 0.27	4.33 ± 0.28	−3.1 (−9.7, 3.4)	3.07 ± 0.30	−35.0 (−44.7, −25.3)	
P (treatment effect)	0.971					
Serum CTx (ng/mL)						0.047
Control group	0.36 ± 0.03	0.33 ± 0.02	−7.6 (−19.5, 11.9)	0.27 ± 0.02	−18.1 (−37.4, 1.2)	
Calcium-supplemented group	0.34 ± 0.05	0.34 ± 0.04	1.7 (−21.1, 24.6)	0.27 ± 0.04	−15.9 (−40.3, 8.5)	
Dairy intervention group	0.40 ± 0.02	0.32 ± 0.02	−19.1 (−25.7, −12.6)	0.30 ± 0.02	−23.1 (−29.3, −16.9)	
P (treatment effect)	0.437	0.897		0.618		

Manios Y et al Am J Clin nutr 2007

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Dietary patterns, bone geometry and hip fracture

Rotterdam Study : 4028 subjects >55 years

- basal dietary intake, BMD and bone geometry
- mean follow up 14,8 years

Pattern "Fruit, vegetables and dairy"

	cross sectional association (β CI)
BMD	0,14 (0,12-017) *
Section modulus (bending strength)	0.13 (0.11, 0.16) *
Buckling ratio (instability)	-0.12 (-0.14, -0.09) *
	adjusted HR (% CI)
Fracture risk	0.90 (0.83, 0.96) *
Hip fracture risk	0.85 (0.81, 0.89) *

de Jonge E et al. Am J Clin Nutr 2017;105:203–11

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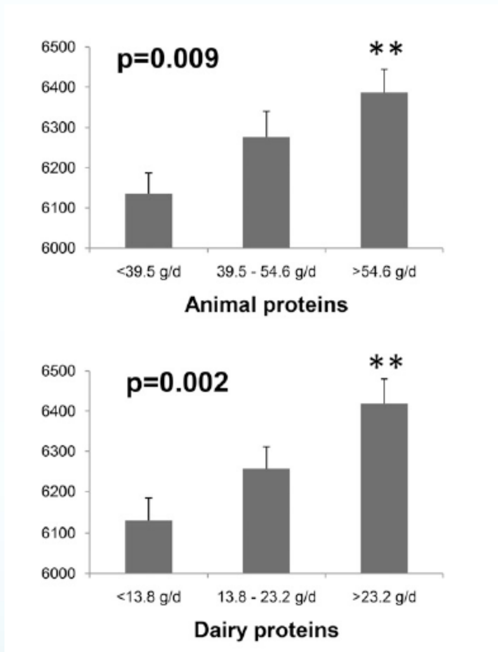
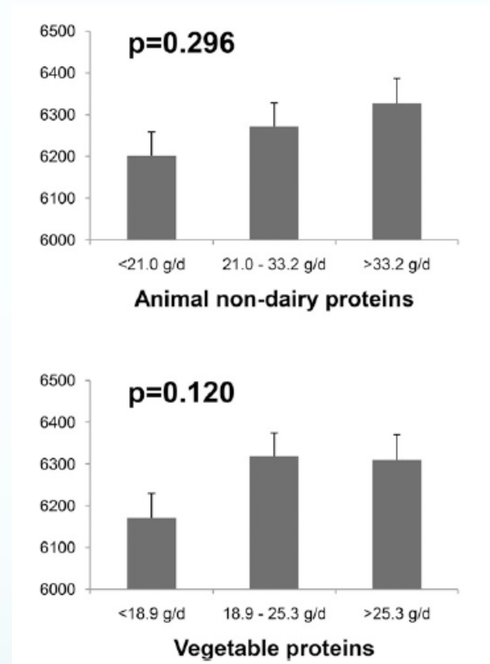
Dietary proteins, bone strength and microstructure

- 746 women, mean age: 65 years
- distal tibia





→ **Beneficial effect of dairy protein intake on trabecular microstructure**

Durosier-Izart C et al Am J Clin Nutr. 2017 doi: 10.3945/ajcn.116.134676

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Dairy products and fracture

Epidemiological studies: inconsistent data

- **Protective association of milk intake on the risk of hip fracture: results from the Framingham Original Cohort**
  milk intake >7 servings/week → ↘ 40% hip fracture

JBMR Sahni S et al, 2014 ASBMR

Milk intake and risk of mortality and fractures in women and men: cohort studies

- milk intake > 600 ml/d → ↗ fracture

Michaëlsson K et al . 2014 thebmj

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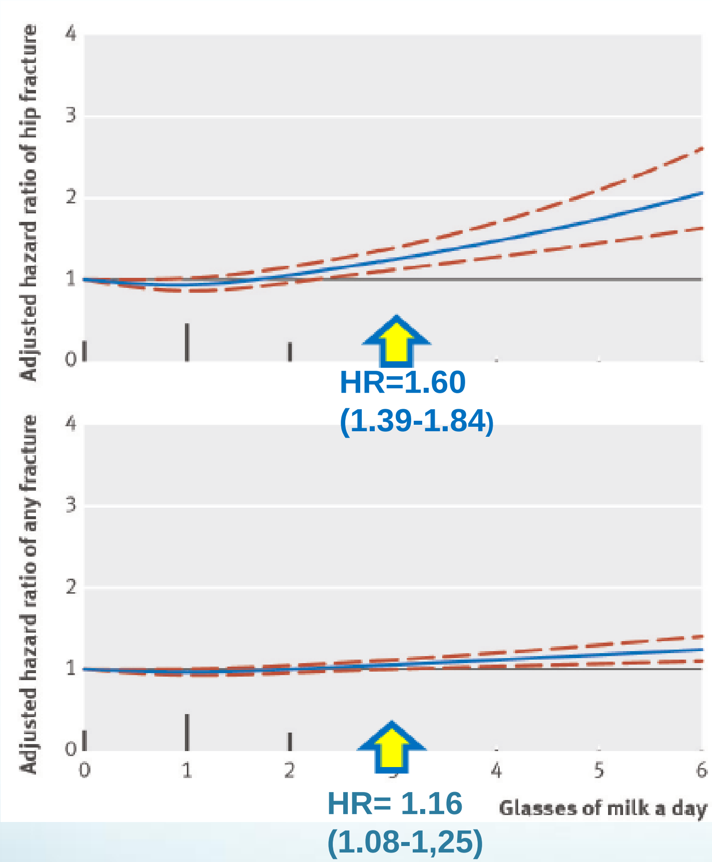
Dairy products and fracture



- Milk fracture risk in women (but not men)

- Very high milk intake (>600ml/d)
- Milk fortified with high dose of vitamin A

- Fermented milk and cheese ↘ fracture risk in men and women

- Not adjusted for baseline vit D and physical activit

Michaëlsson K et al . 2014 thebmj

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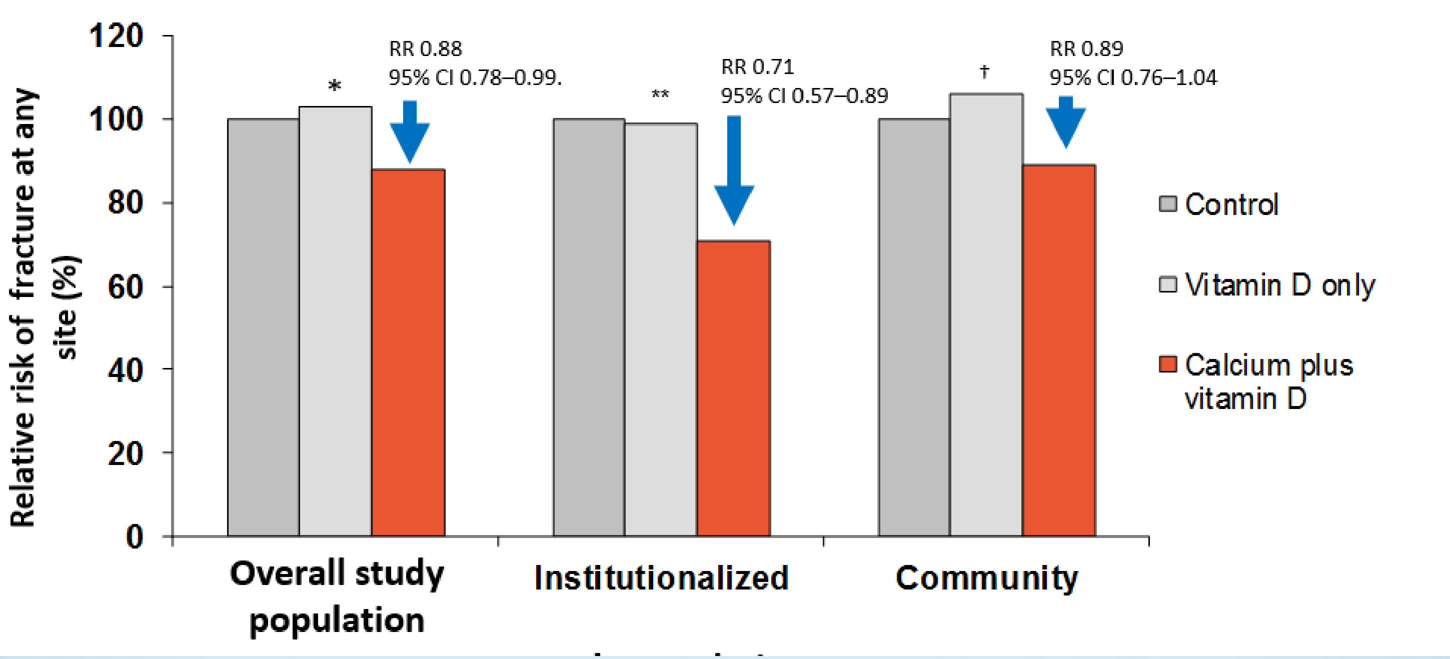
Ca + vitamin D and risk of fracture

Calcium + vit D, but not vit D alone, is associated with a reduction in fracture risk

- Sub-analysis of USPSTF meta-analysis: 11 studies of calcium 500–1200 mg/d + vit D (300–1100 IU/d), or vit D alone (400–1370 IU/d) for the prevention of fractures
- 52,915 people, mostly postmenopausal women.

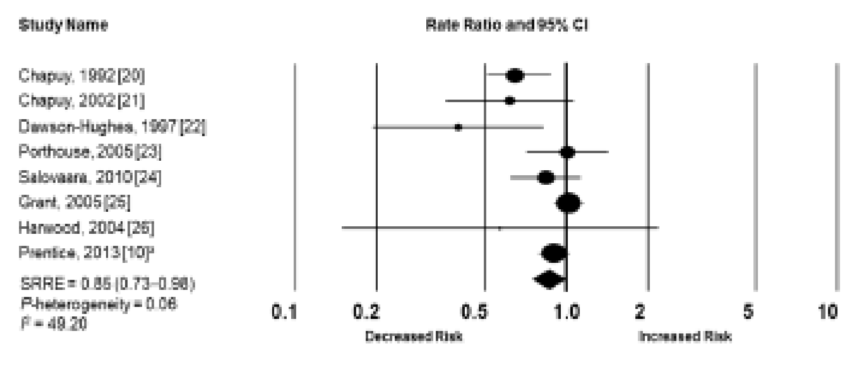


*Chung M, et al. Ann Intern Med **2011***

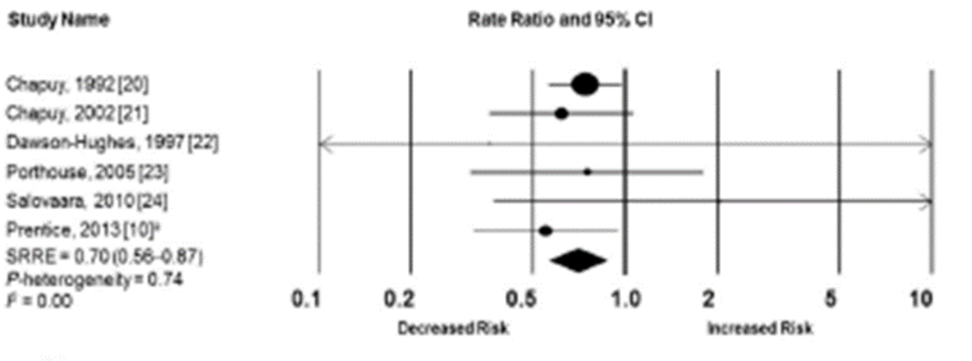
Ca + vitamin D and risk of total fractures

Meta-analysis from the National Osteoporosis Foundation

- **Total fracture : 15% reduced risk**



- **Hip fracture: 30% reduced risk**



Weaver CM et al Osteoporos Int 2016

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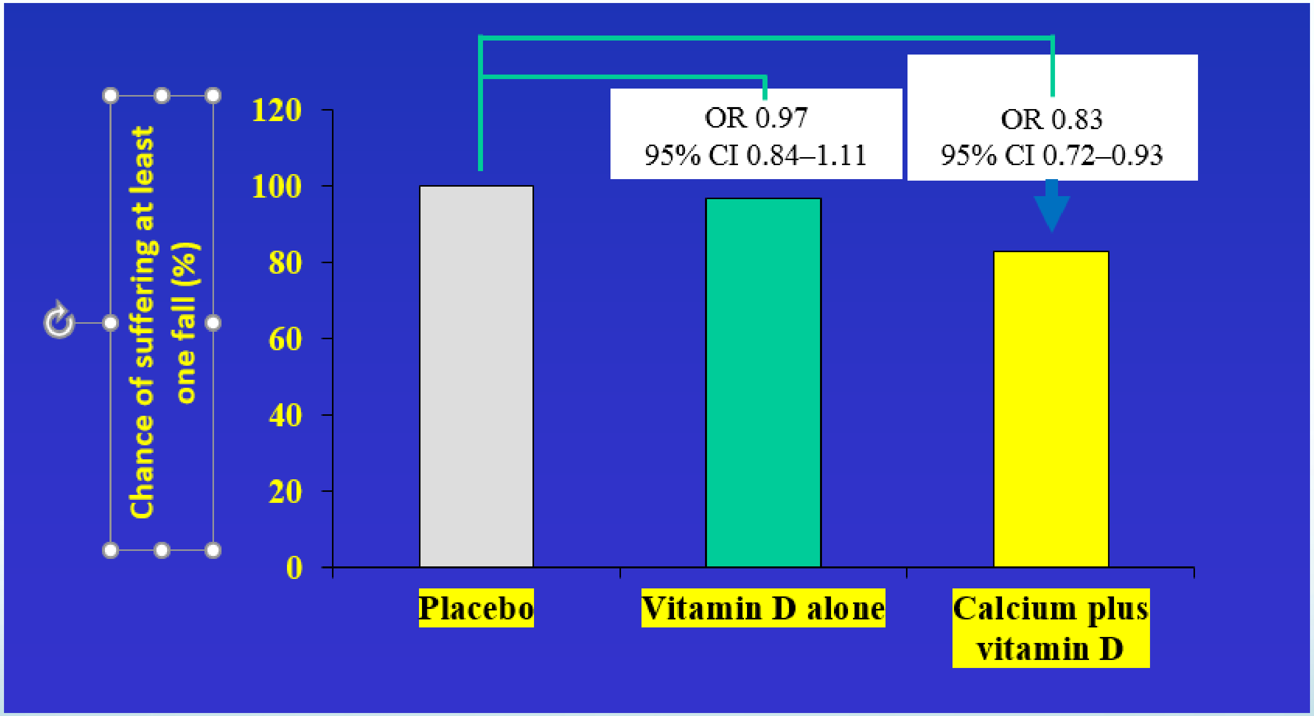
Ca + vitamin D and risk of falls

- Meta-analysis 26 trials, 45,782 participants, majority elderly females; mean age 76; duration of supplementation 3–62 months.
- Subgroup analysis of 10 studies of vitamin D ± calcium supplementation at any dose.



Murad MH, et al. J Clin Endocrinol Metab ***2011***

Sarcopenia and fractures

Musculosleletal health: A recent awareness of the problem

Aging Clin Exp Res. 2015 Nov 12. [Epub ahead of print]

Osteosarcopenia is more than sarcopenia and osteopenia alone.

Drey M[1], Sieber CC[2], Bertsch T[3], Bauer JM[4], Schmidmaier R[5]; FiAT intervention group.

PERSPECTIVE JBMR

Bone and Skeletal Muscle: Neighbors With Close Ties

Douglas J DiGirolamo, Douglas P Kiel, and Karyn A Esser

ORIGINAL ARTICLE

Sarcopenia and its relationship with bone mineral density in middle-aged and elderly European men

« Dysmobility syndrome »

Muscular strength measurements indicate bone mineral density loss in postmenopausal women

Maturitas. 2013 Jun;75(2):175-80. doi: 10.1016/j.maturitas.2013.03.016. Epub 2013 Apr 28.

Relationship between postmenopausal osteoporosis and the components of clinical sarcopenia.

Sjöblom S, Suuronen J, Rikkonen T, Honkanen R, Kröger H, Sirola J.

OPINION PAPER

What's in a name revisited: should osteoporosis and sarcopenia be considered components of "dysmobility syndrome?"

N. Binkley · D. Krueger · B. Buehring

Reginster JY, Beaudart C, Buckinx F, Bruyère O. Osteoporosis and sarcopenia: two diseases or one? Curr Opin Clin Nutr Metab Care. 2016 Jan;19(1):31-6.

Associations of fat and muscle masses with bone mineral in elderly men and women[1–3]

Richard N Baumgartner, Patricia M Stauber, Kathleen M Koehler, Linda Romero, and Philip J Garry

PERSPECTIVE JBMR

Forum on Bone and Skeletal Muscle Interactions: Summary of the Proceedings of an ASBMR Workshop

Ageing Research Reviews

Review

Muscle and bone, two interconnected tissues

REVIEW

The skeletal muscle secretome: an emerging player in muscle–bone crosstalk

Mark W Hamrick

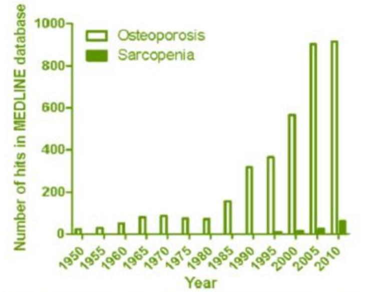
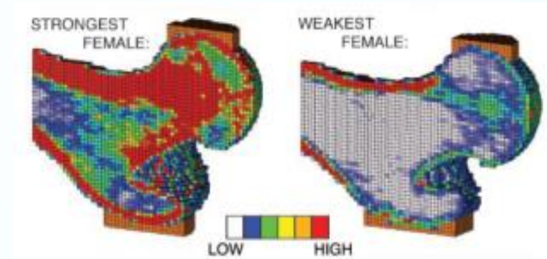
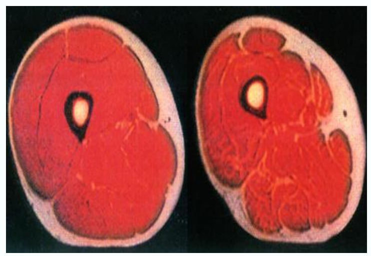


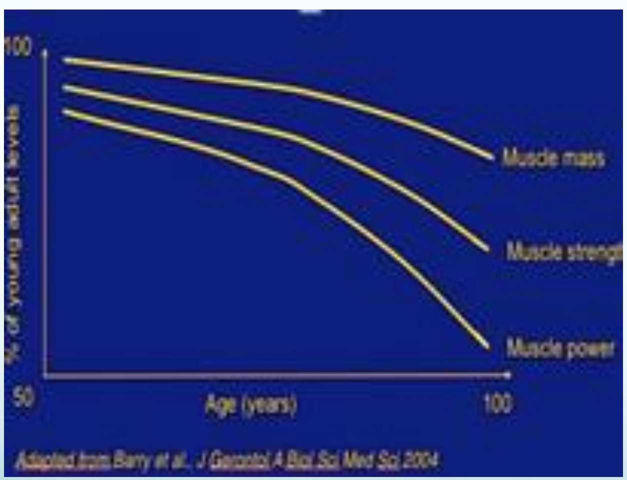
Fig. 2. Amount of hits in the MEDLINE database with the term "osteoporosis" (white bars) and "sarcopenia" (black bars). Both terms were entered as a single term in the MEDLINE database search engine per year with 5-year intervals.

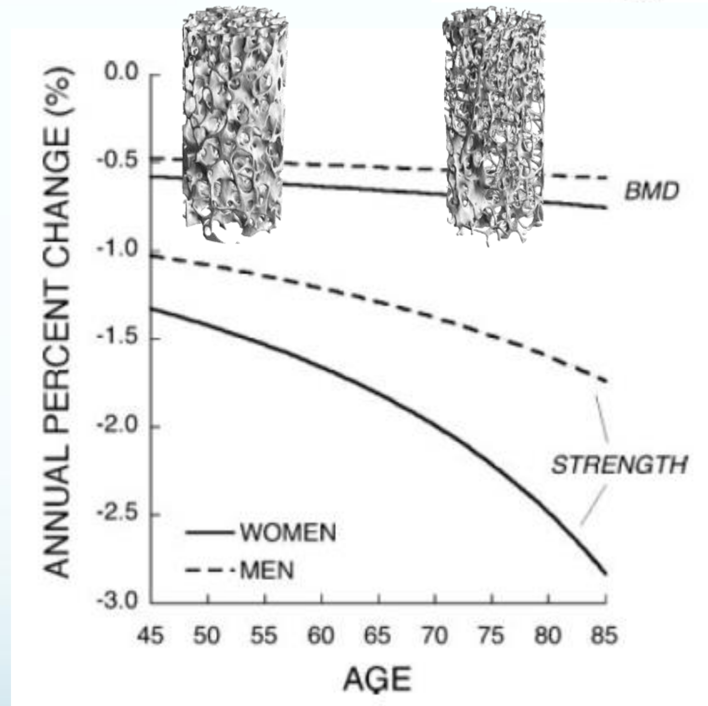
Osteoporosis and sarcopenia

Bone and muscle: similar temporal patterns





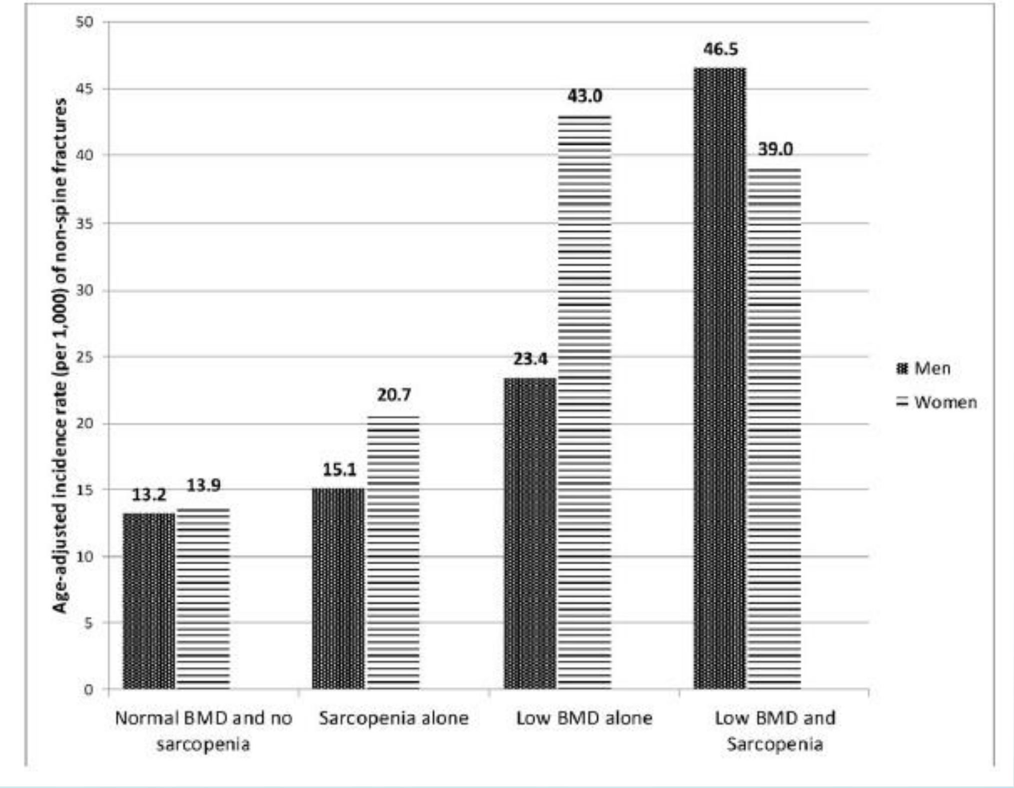




Sarcopenia and fractures

- **Osteoporotic Fractures in Men study**: 5544 men, 74 years, follow-up: 9 years
- **Study of Osteoporotic Fractures in women**: 1114 women, 77,6 years, follow up: 8 years

Age-adjusted incidence rate (per 1,000) of non-spine fractures



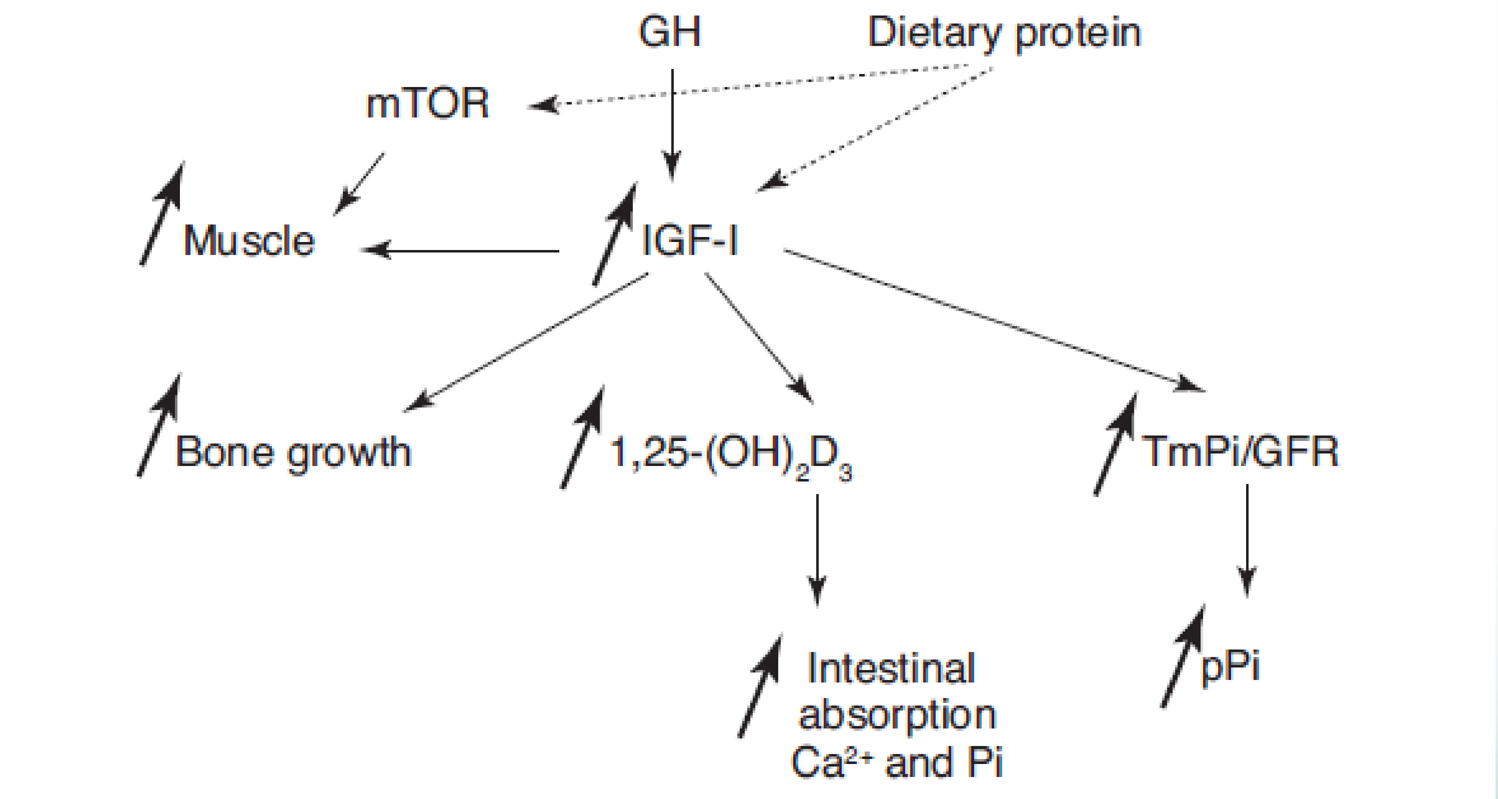
Chalhoub et al J Am Geratr Soc 2015

Protein and muscle

Protein is an anabolic stimulus

Dietary protein, muscle and bone

Pathways through which dietary protein influences muscle anabolism and bone growth

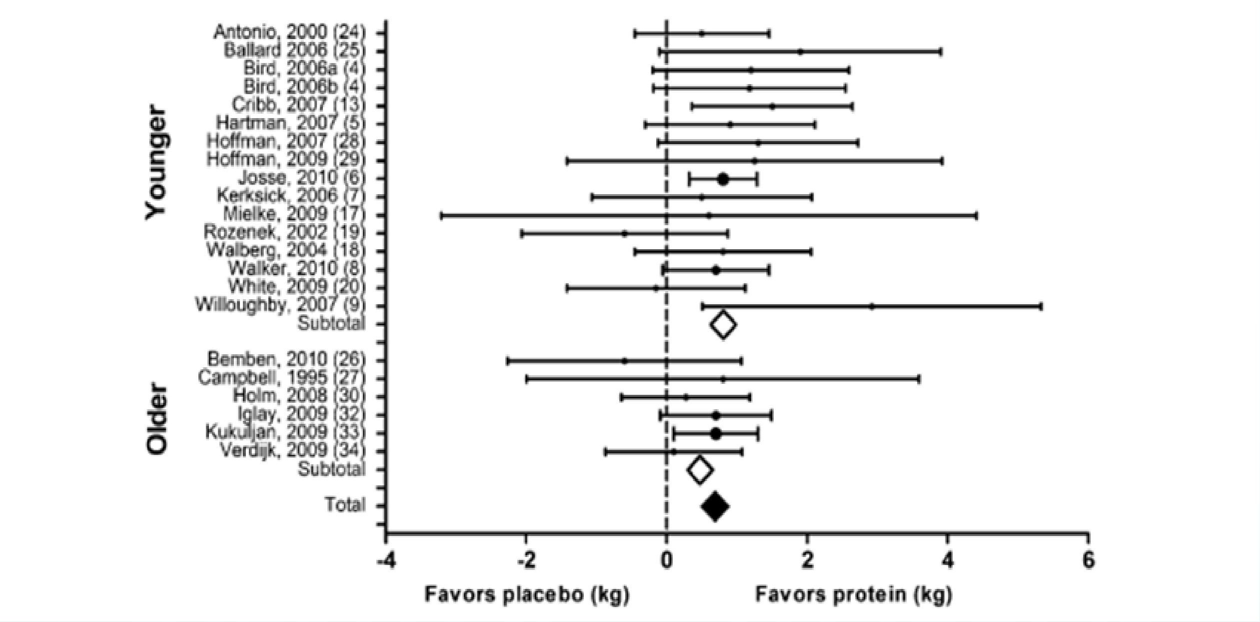


Rizzoli R et al. Maturitas; 2014

Resistance training + protein supplementation

Meta-analysis of 22 RCT

- **resistance-type exercise training + protein supplementation** (19 RCT with milk proteins) or placebo
- **mean duration :** 12 weeks



Mean fat free mass gain

- **Younger: 0,8 kg**
- **Older: 0,5 kg**

Cermak et al, AJCN 2012

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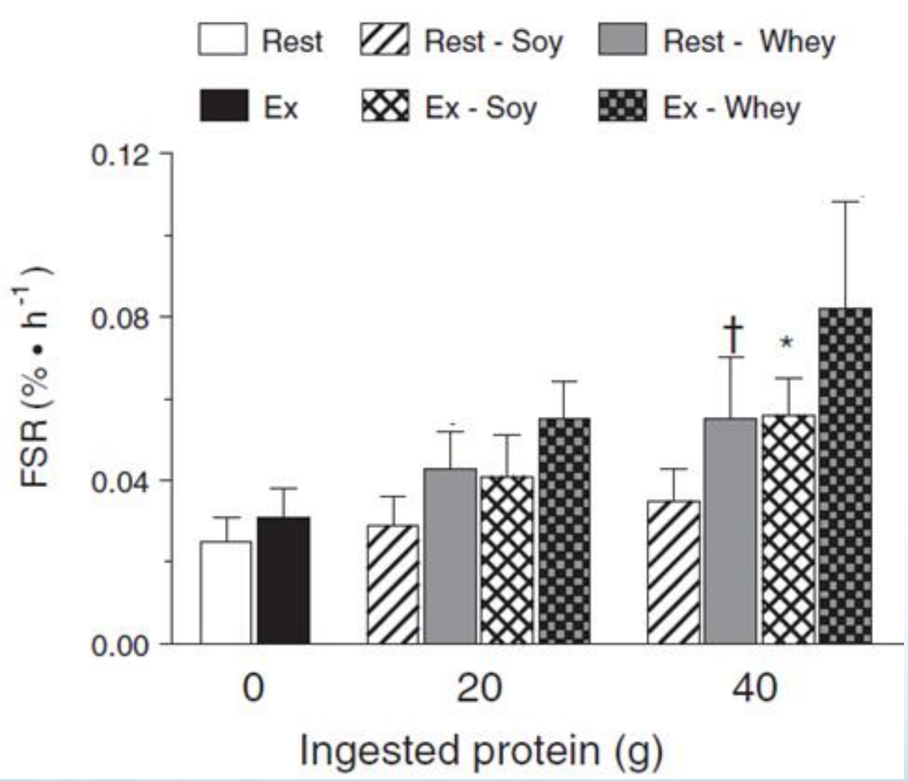
Soy versus whey protein in elderly

Myofibrillar protein fractional synthetic rate (%•h-1) for whey and soy (20 g and 40 g) groups
and a group who consumed no protein (0 g) at rest and following resistance exercise (Ex)



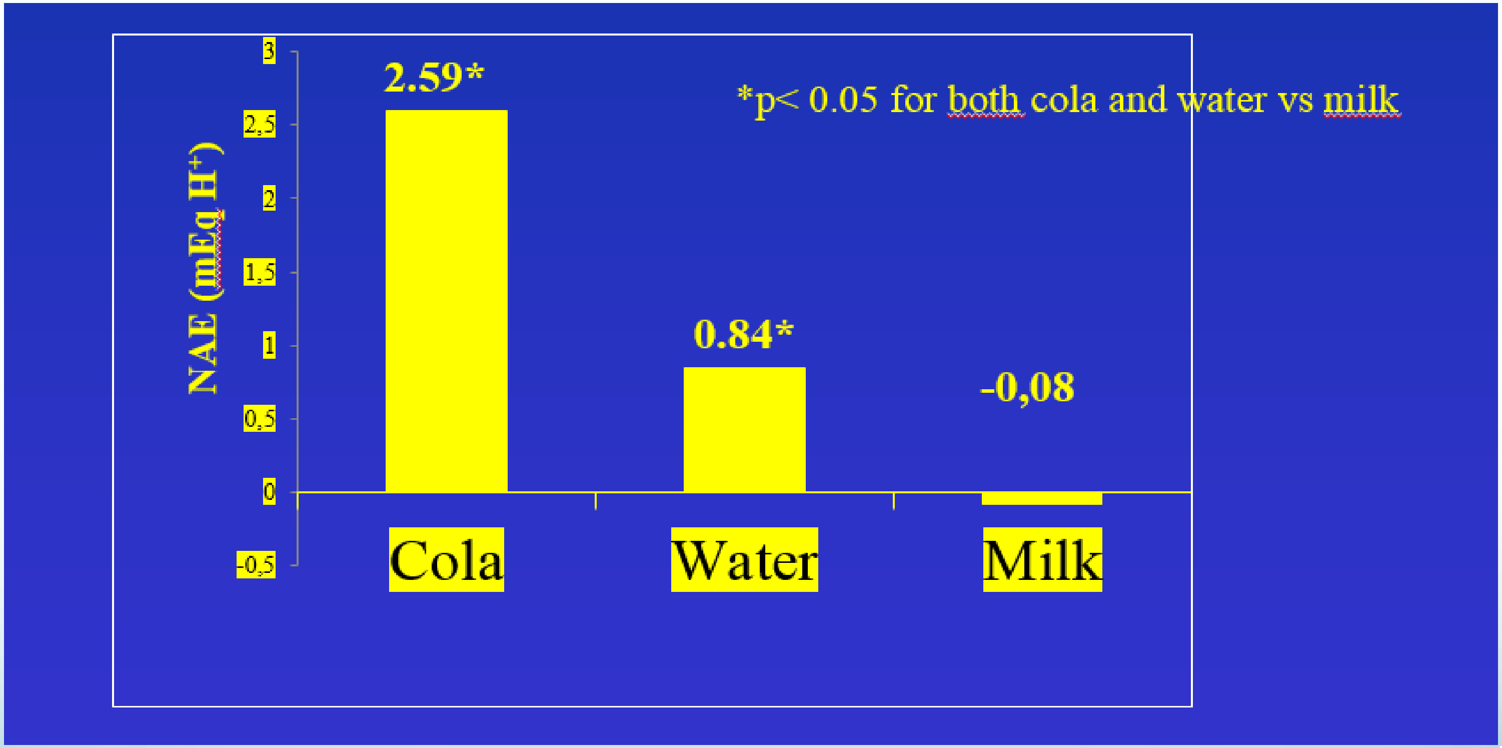
Yang et al, Nutr Metab 2012

Fantasy

- The acid-ash hypothesis is not supported by evidence
- Dairy products don’t increase cancer risk
- Dairy products don’t increase cardiovascular risk
- Dairy products don’t make fat
- Lactose maldigestion does not mean lactose intolerance

The acid ash hypothesis is not supported by evidence

- Diet does not change systemic pH or cause or “acidification”
- Milk does not increase acid excretion

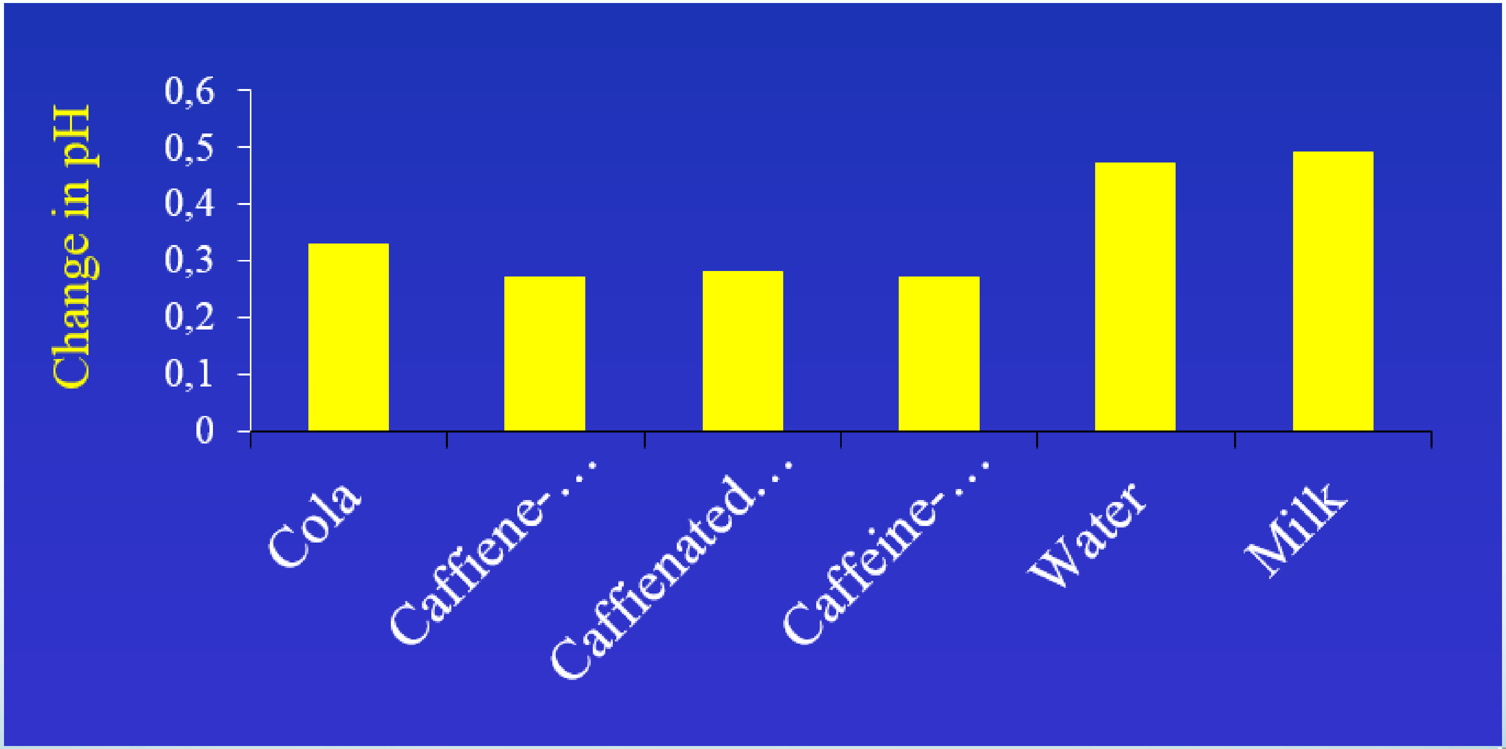


Heaney R et al 2001

The acid ash hypothesis is not supported by evidence

- Diet does not change systemic pH or cause or “acidification”
- Milk does not increase acid excretion and higher urinary pH is less acidic

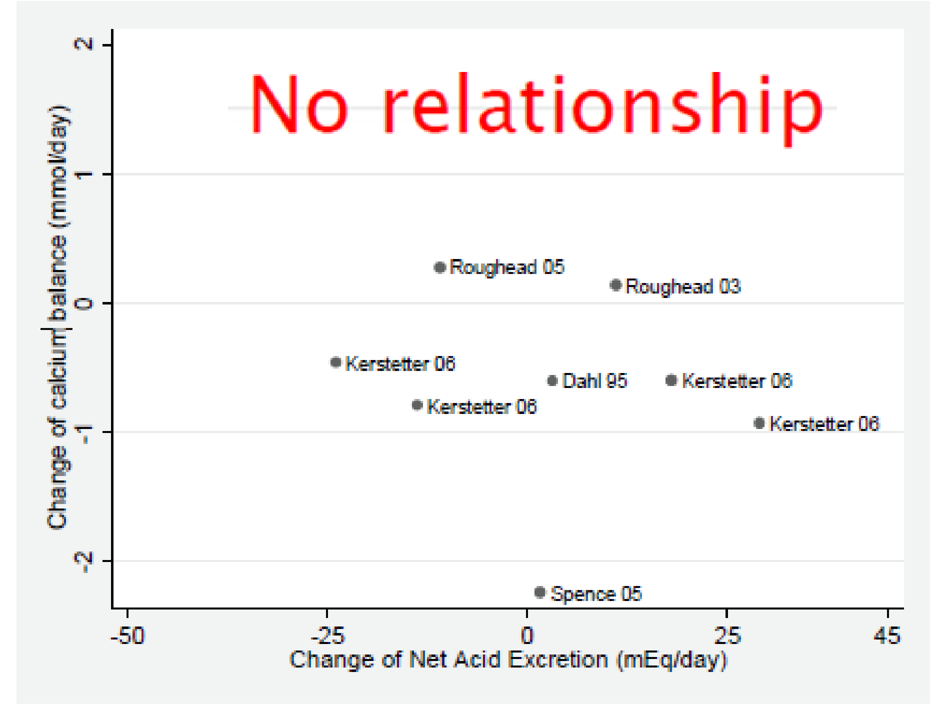
Change in urinary pH after ingestion of various liquids



Heaney R et al 2001

The acid ash hypothesis is not supported by evidence

- Diet does not change systemic pH or cause or "acidification"
- Milk does not increase acid excretion and higher urinary pH is less acidic
- Acid excretion is not associated with lower calcium balance, that is: poorer calcium balance



Fenton TR et al Nutr J 2011
Rizzoli R et al Maturitas 2014

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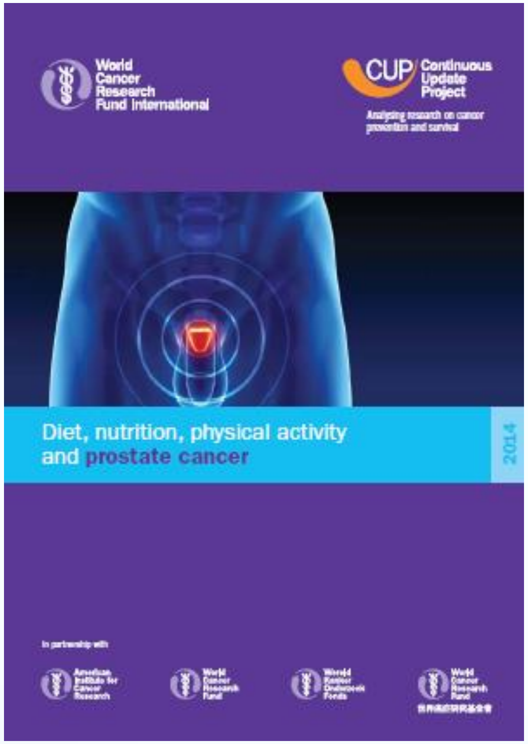
Dairy products and prostate cancer



WCRF CUP 2014

DIET, NUTRITION, PHYSICAL ACTIVITY AND PROSTATE CANCER

		DECREASES RISK	INCREASES RISK
STRONG EVIDENCE	Convincing		
	Probable		Body fatness (advanced prostate cancer)[1,2] Adult attained height[3]
LIMITED EVIDENCE	Limited-suggestive		Dairy products Diets high in calcium Low plasma alpha-tocopherol concentrations Low plasma selenium concentrations
	Limited-no conclusion	Cereals (grains) and their products, dietary fibre, potatoes, non-starchy vegetables, fruits, pulses (legumes), processed meat, red meat, poultry, fish, eggs, total fat, saturated fatty acids, monounsaturated fatty acids, polyunsaturated fatty acids, plant oils, sugar (sucrose), sugary foods and drinks, coffee, tea, alcoholic drinks, carbohydrate, protein, vitamin A, retinol, alpha carotene, lycopene, folate, thiamin, riboflavin, niacin, vitamin C, vitamin D, vitamin E supplements, gamma-tocopherol, multivitamins, selenium supplements, iron, phosphorus, calcium supplements, zinc, physical activity, energy expenditure, vegetarian diets, Seventh-day Adventist diets, individual dietary patterns, body fatness (non-advanced prostate cancer), birth weight, energy intake	
STRONG EVIDENCE	Substantial effect on risk unlikely	Beta-carotene[4,5]	

CUP Panel's conclusions (pages 15, 17)

For a higher consumption of dairy products, the evidence suggesting an increased risk of prostate cancer is limited.

For diets high in calcium, the evidence suggesting an increased risk of prostate cancer is limited.

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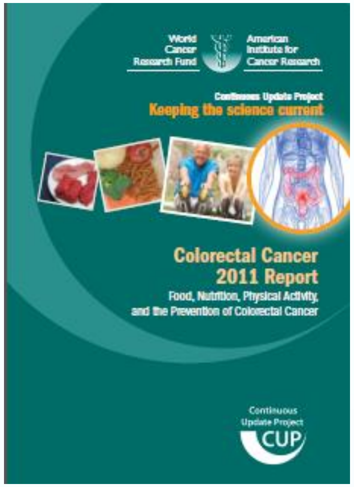
Diary products and colon cancer

WCRF Continuous Update Project 2011



FOOD, NUTRITION, PHYSICAL ACTIVITY AND CANCERS OF THE COLON AND THE RECTUM 2011

	DECREASES RISK	INCREASES RISK
Convincing	**Physical activity**[1,2] **Foods containing dietary fibre**[3]	**Red meat**[4,5] **Processed meat**[4,6] **Alcoholic drinks (men)**[7] **Body fatness** **Abdominal fatness** **Adult attained height**[8]
Probable	Garlic Milk[9] Calcium[10]	**Alcoholic drinks (women)**[7]
Limited - suggestive	Non-starchy vegetables Fruits Foods containing vitamin D[3,12]	Foods containing iron[3,4] Cheese[11] Foods containing animal fats[3] Foods containing sugars13
Limited - no conclusion	Fish; glycaemic index; folate; vitamin C; vitamin E; selenium; low fat; dietary pattern	
Substantial effect on risk unlikely	None identified	

Milk: *"The evidence on milk from cohort studies is reasonably consistent, supported by stronger evidence from dietary calcium as a marker. There is evidence for plausible mechanisms.*
Milk probably protects against colorectal cancer."

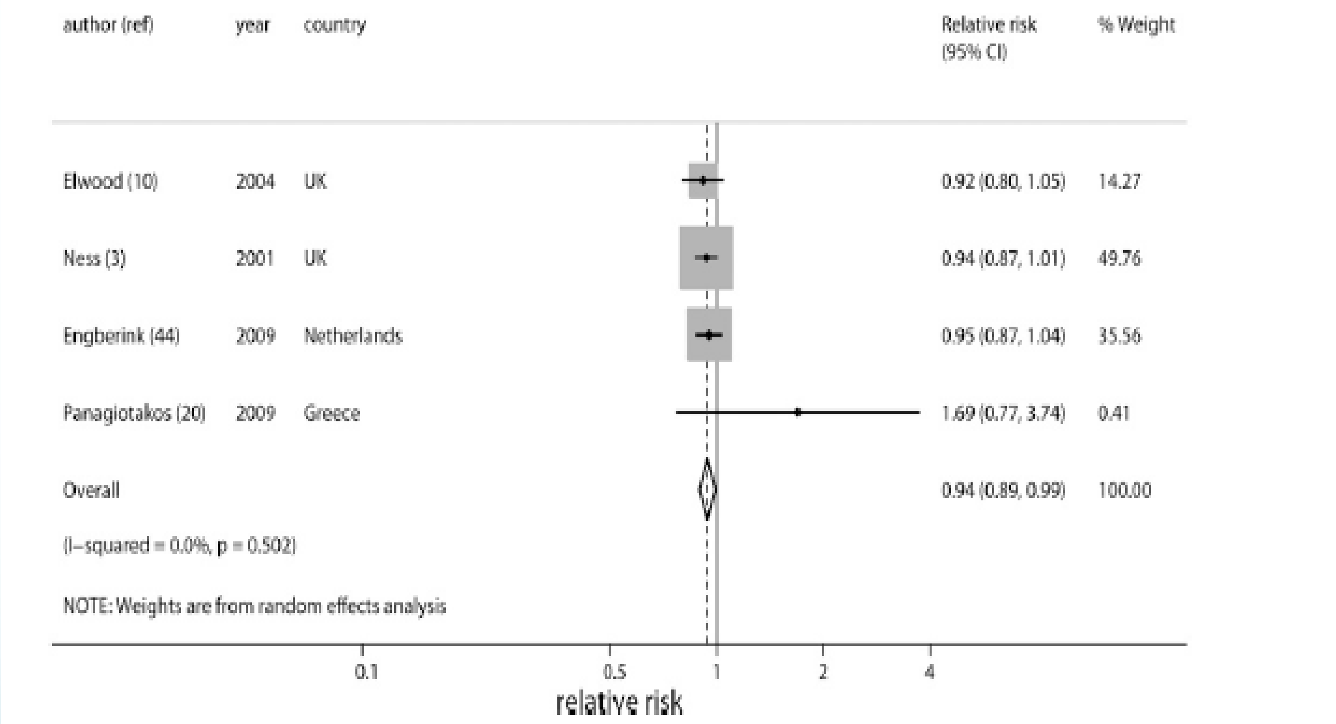
Cheese: *" The evidence suggesting that cheese is a cause of colorectal cancer is limited."*

Dairy products and cardiovascular diseases

Relation between milk (per 200 mL/d) and cardiovascular disease:

- dose-response meta-analyses of 4 prospective cohort studies (n = 13,518, no.of cases = 2283)

RR 0.94 (0.89-0.99)



Soedamah-Muthu SS et al., Am J Clin Nutr 2011

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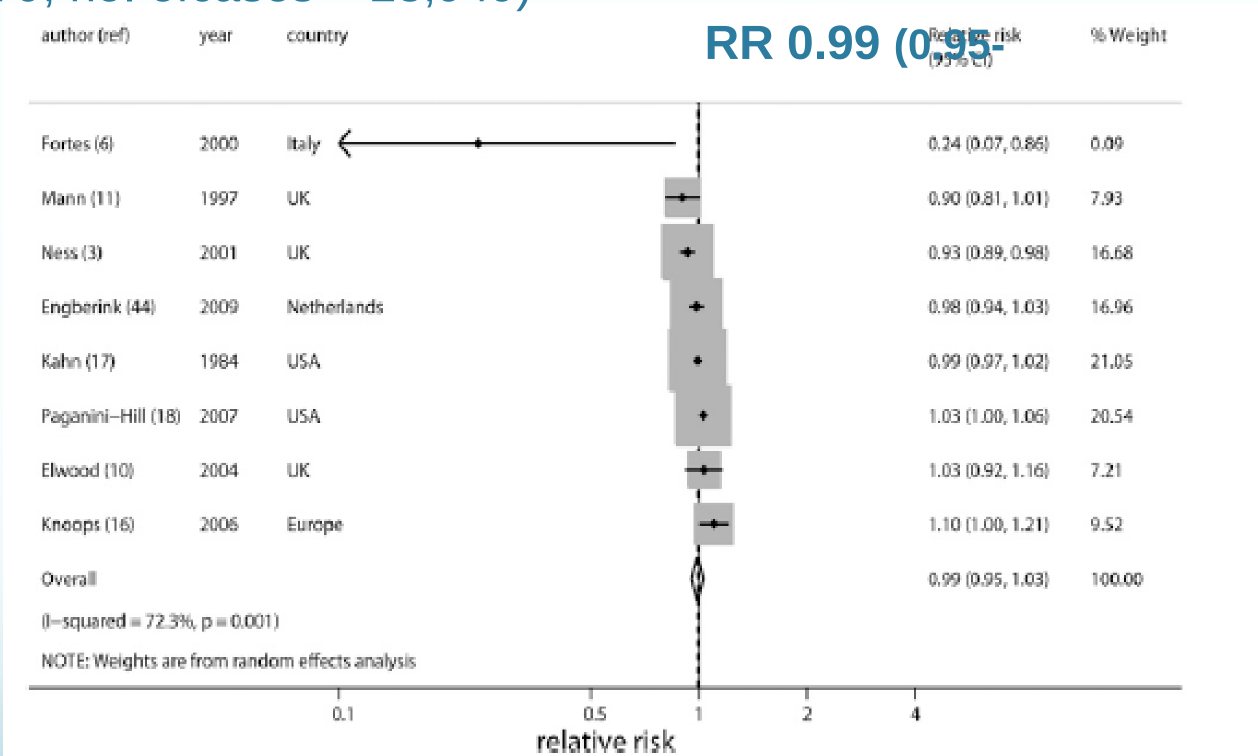
Dairy products and cardiovascular diseases

Relation between milk (per 200 mL/d) and all-cause mortality:

- dose-response meta-analyses of 8 prospective cohort studies
  (n = 62,779, no. ofcases = 23,949)

RR 0.99 (0,95-1.03)



Soedamah-Muthu SS et al Am J Clin Nutr 2011

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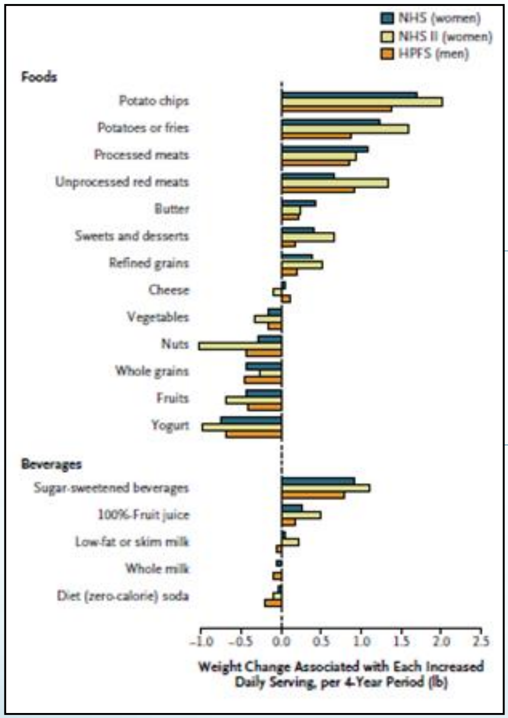
Dairy products and weight
Observational studies

Relationships between changes in food consumption and weight change every 4 years (Nurses' and Heath Professionals US cohorts)



Intake of dairy is inversely associated with body fat in observational studies; there is no difference between high vs low-fat dairy

Mozzafarian et al New Engl J Med 2011

Lactose intolerance

EFSA *Scientific Opinion* 2010

Lactose intolerance can be due to genetic non-persistence of lactase. Dietary lactose is not or incompletely split by intestinal lactase and residual lactose is fermented by the colonic microbiota leading to abdominal symptoms.

Lactose tolerance varies widely among individuals with lactose maldigestion. A single threshold of lactose for all lactose intolerant subjects then cannot be determined. Symptoms of lactose intolerance have been described after intake of less than 6 g of lactose in some subjects. The vast majority of subjects with lactose maldigestion will tolerate acute doses of up to 12 g lactose (250 ml of milk) as a single dose with no or minor symptoms. Higher doses may be tolerated if distributed throughout the day.

NB: Yogurts, hard cheeses, and reduced-lactose foods may be effective management approaches.

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Dairy products as a source of key « bone » nutrients

100 ml of full fat milk:

- **Protein: 3,3 g**
- **Calcium: 119 mg**
- **Potassium: 151 mg**
- **Phosphorus: 93 mg**
- **Magnesium: 12 mg**

Bioavailability of dietary calcium

		Ca content (mg)	Ca absorption (%)	Ca absorbed (mg)
	Milk : 250 ml	300	32	90
	Cabbage : 550 g	300	32	90
	Spinach : 150 g	300	5	15

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