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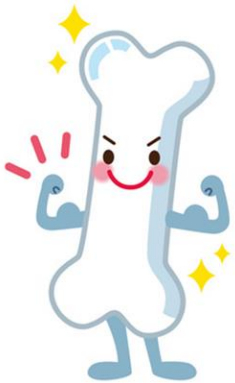
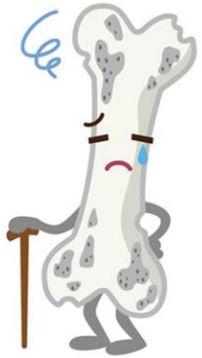
FACULTÉ DE MÉDECINE

Supplemente/Ernährung in der Osteoporose-Prävention: Was gibt's Neues?





Emmanuel BIVER

Division of Bone Diseases, Geneva University Hospitals and Faculty of Medicine, Switzerland

OSTEOPOROSE-UPDATE 2025, 03.05.2025 St. Urban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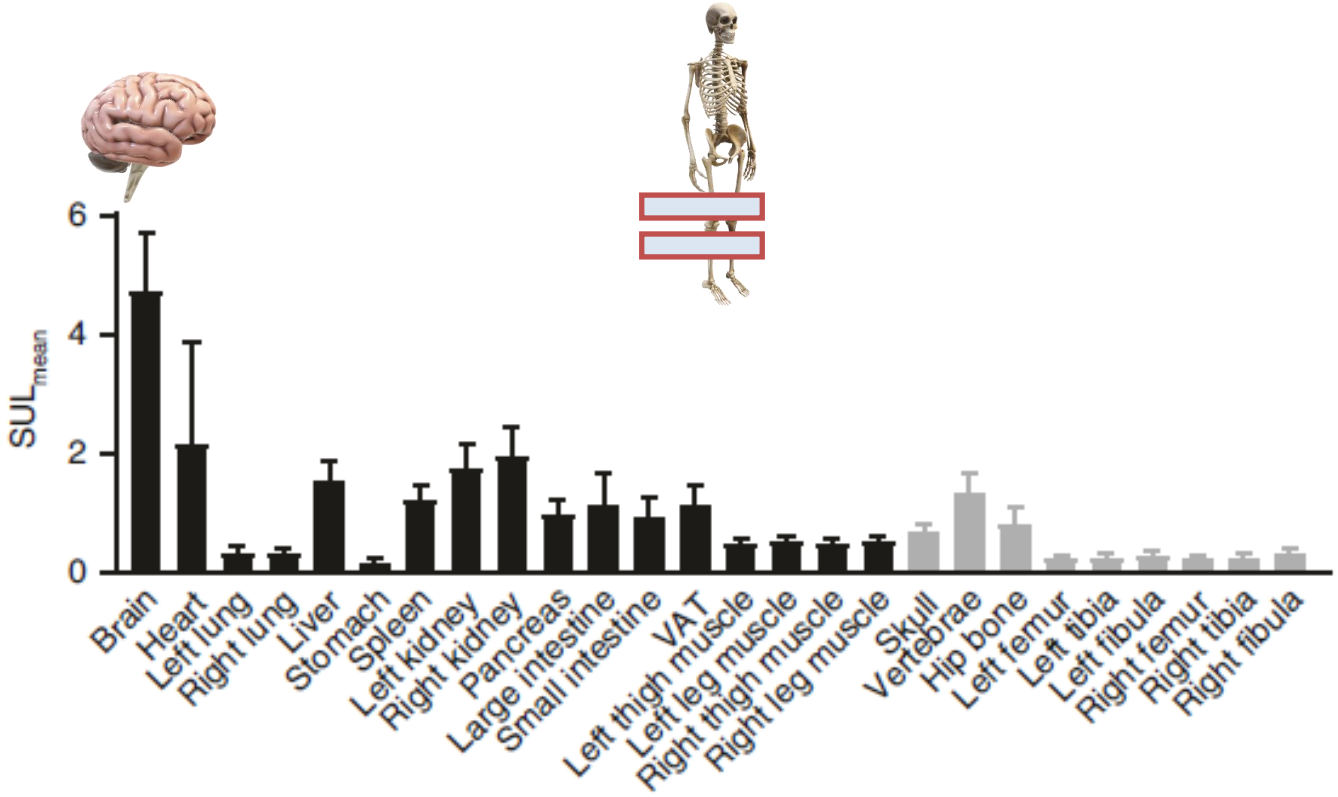
ER
and Faculty of Medicine, Switzerland
.2025 St. Urban

Our bones need energy…



Glucose uptake measurements using total-body PET/CT

Lu W et al. *Bone Res.* 2023 Jul 6;11(1):36.

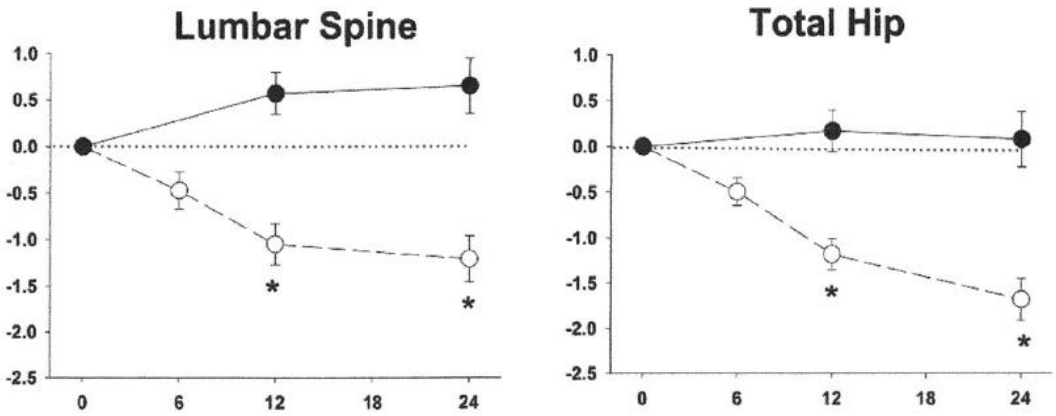
Energy intake and bone health

CLINICAL TRIAL

JBMR®

Effect of Two-Year Caloric Restriction on Bone Metabolism and Bone Mineral Density in Non-Obese Younger Adults: A Randomized Clinical Trial

ad libitum group (●) or caloric restriction (○).



Villareal DT et al. J Bone Miner Res. 2016 Jan;31(1):40-51.

Our bones need energy and a balanced diet

→ Calcium, proteins, fibers, other micronutrients…

Low CALCIUM diet

↓

- Bone resorption to release calcium
- Impaired bone mineralisation

Low PROTEIN diet

↓

- Poor bone matrix formation
- Poor muscle health and risk of falling

Rizzoli R, **Biver E**, Brennan-Speranza TC. *Lancet Diabetes Endocrinol*. 2021 Sep;9(9):606-621.

Let’s talk about your diet…

I am very careful Doctor…

Let’s talk about your diet…

I am very careful Doctor…

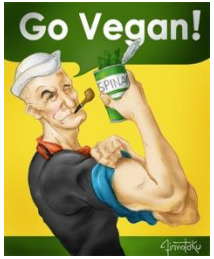
The New York Times | http://nyti.ms/1BIXyDl

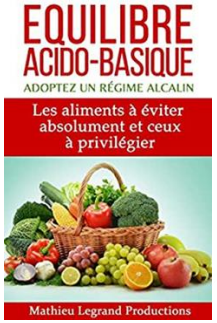
The Upshot

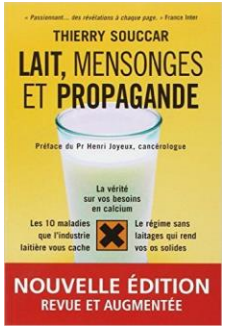
Got Milk? Might Not Be Doing You Much Good

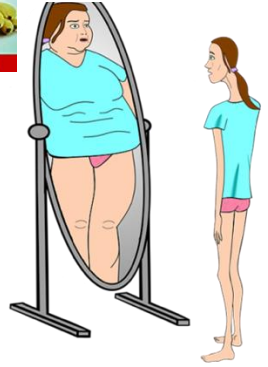
Aaron E. Carroll

THE NEW HEALTH CARE NOV. 17, 2014









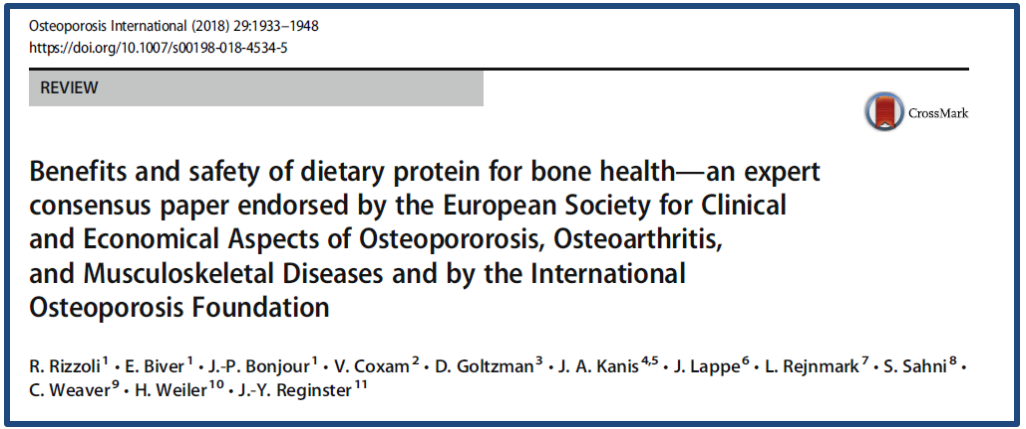
Fracture risk according to protein intake (high vs low) in meta-analyses

Méta-analyse	Population	Fracture site	Total proteins		Animal proteins		Vegetable proteins	
			Number of studies	Risk (95% CI)	Number of studies	Risk (95% CI)	Number of studies	Risk (95% CI)
Darling, 2009	Adults ≥ 18 yrs	Hip	3	RR 0.75 (0.47, 1.21)	3	RR 0.83 (0.54, 1.30)	2	RR 1.21 (0.82, 1.79)
Wu, 2015	Adults ≥ 18 yrs	All	3	RR 0.99 (0.97, 1.02)	2	RR 0.79 (0.32, 1.96)		
		Hip	6	RR 0.89 (0.82, 0.97)*	4	RR 1.04 (0.70, 1.54)		
Wallace, 2017	Adults ≥ 18 yrs	Hip	5	RR 0.84 (0.73, 0.95)*				
Groenendijk, 2019	Adults >65 yrs	Hip			4	HR: 0.89 (0.84, 0.94)*		
Darling, 2019	Adults ≥ 18 yrs	All	4	RR 0.94 (0.72, 1.23)	4	RR 0.98 (0.76, 1.27)	3	RR 0.97 (0.89, 1.09)
			3	HR 0.82 (0.59, 1.14); 0.79# (0.64, 0.97)*				
			3	OR 0.69 (0.30, 1.68)				

RR relative risk (Cohort studies); HR hazard ratio (Cohort studies) ; OR odd ratio (Case-control studies);
* Statistically significant; # if removal the study with low calcium intake.

Biver E et al . Joint Bone Spine. 2023 May;90(3):105521.

Dietary protein intake



Osteoporosis International (2018) 29:1933–1948
https://doi.org/10.1007/s00198-018-4534-5

REVIEW

CrossMark

Benefits and safety of dietary protein for bone health—an expert consensus paper endorsed by the European Society for Clinical and Economical Aspects of Osteopororosis, Osteoarthritis, and Musculoskeletal Diseases and by the International Osteoporosis Foundation

R. Rizzoli[1] · E. Biver[1] · J.-P. Bonjour[1] · V. Coxam[2] · D. Goltzman[3] · J. A. Kanis[4,5] · J. Lappe[6] · L. Rejnmark[7] · S. Sahni[8] · C. Weaver[9] · H. Weiler[10] · J.-Y. Reginster[11]

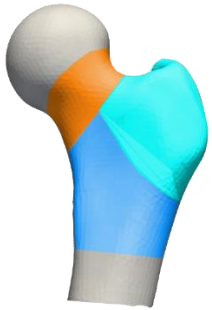
- In elderly patients with osteoporosis, protein intakes above 0.8 g/kg/d are associated with higher bone mineral density, lower bone loss and lower risk of hip fracture, provided that dietary intakes in calcium are adequate*.

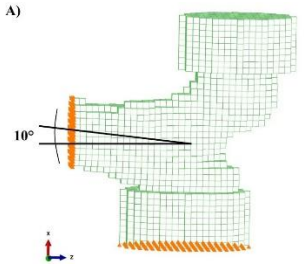
* Sahni S et al. *J Bone Miner Res*. 2010 Dec;25(12):2770-6; Dargent-Molina P et al. *J Bone Miner Res*. 2008 Dec;23(12):1915-22.

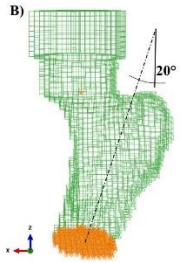
Response to treatment: Change of hip strength (%/yr)

		No osteoporosis medication n = 418	Bisphosphonate/ denosumab/raloxifene n = 67
Total		-2.2% (-4.3%, -0.4%)	-0.5% (-2.2%, 1.1%)
Total calcium intake (diet + supplements)	≥1200mg/d	-2.1% (-4.2%, -0.4%)	-0.5% (-1.9%, 1.1%)
	<1200mg/d	-2.4% (-4.3%, -0.3%)	-0.6% (-3.6%, 0.5%)
	P-value	0.657	0.526
Calcium supplements	Yes	-1.7% (-4%, -0.3%)	-0.5% (-2.2%, 0.7%)
	No	-2.6% (-4.3%, -0.4%)	-0.5% (-2%, 1.6%)
	P-value	0.085	0.969
Protein intake	≥ 0.8g/kg	-2.2% (-4.3%, -0.5%)	-0.5% (-1.9%, 1.4%)
	<0.8g/kg	-1.9% (-4.2%, 0.4%)	-2.6% (-3.7%, -0.2%)
	P-value	0.378	**0.040**

Data reported as median (interquartile range)







→ No response to antiresorptive drugs in women with low dietary protein intake

Papageorgiou M et al. WCO IOF oral communication 2025

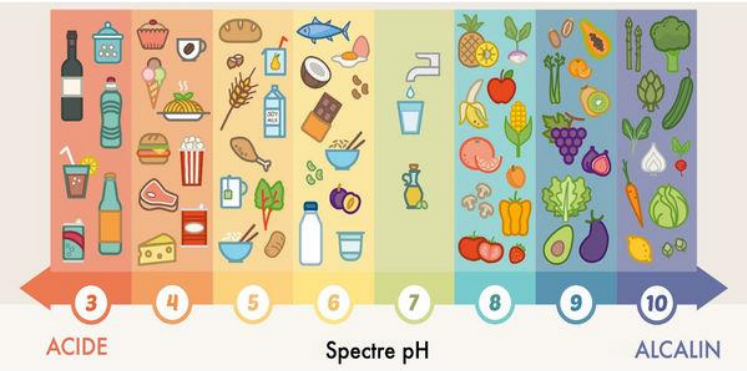
High-protein oral nutrition supplements (ONS)

- In patients with osteoporosis, protein intake should be adapted in line with nutritional status (dietary advice; increase in dietary intake and/or ONSs, such as high-protein drinks).

- The use of ONSs should not be systematic: they should be reserved for undernourished patients only, or when it is difficult to change the patient's diet.

Biver E et al. *Joint Bone Spine*. 2023 May;90(3):105521.

Dietary acid load and bone loss during ageing

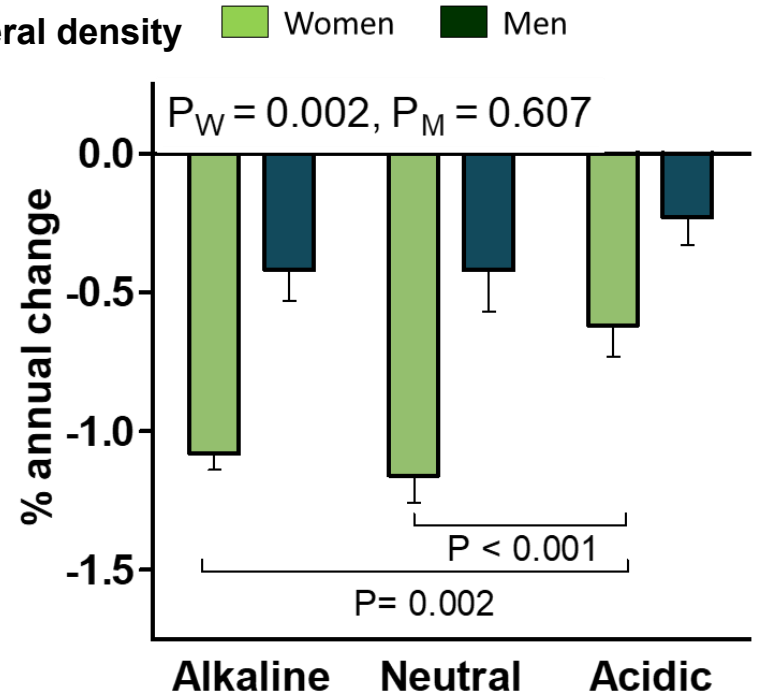


Dietary Acid Load and Bone Health: A Systematic Review and Meta-Analysis of Observational Studies

Gholami F et al. Front Nutr. 2022 May 6;9:869132.

- no significant association between dietary PRAL score and fracture risk/BMD

Bone mineral density
Radius



Papageorgiou M et al. *Am J Clin Nutr*. 2020 Oct 1;112(4):1120-1131.

Fracture risk according to dairy products consumption (high vs low) in meta-analyses

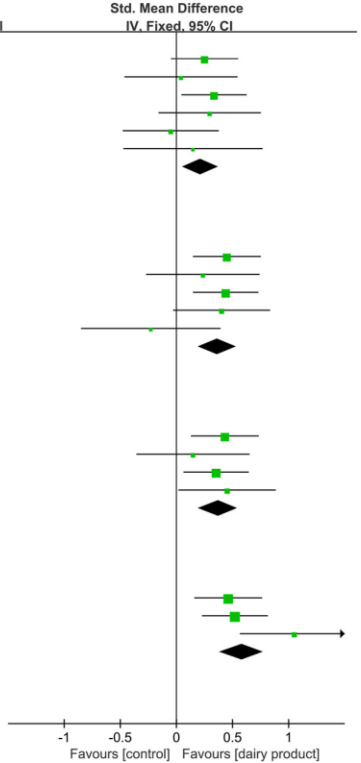
	Fracture	Milk		Yogurts		Cheese	
		Number of studies	Risk (95% CI)	Number of studies	Risk (95% CI)	Number of studies	Risk (95% CI)
Bian et al (2018)	Hip	10	RR 0.91 (0.74, 1.12)	3	RR 0.75 (0.66, 0.86)*	3	RR 0.68 (0.61, 0.77)*
	Hip	7	OR 0.71 (0.55, 0.91)*	1	OR 0.77 (0.39, 1.52)	3	OR 0.77 (0.53, 1.11)
Matia-Martin et al (2019)	All	3	HR 1.05 (0.94, 1.18)	2	HR 0.92 (0.87, 0.98)	2	HR 0.89 (0.81, 0.98)
	Hip	5	HR 0.91 (0.69, 1.21)	5	HR 0.87 (0.71, 1.05)	4	HR 0.80 (0.62, 1.03)
	Vertebra	3	HR 0.81 (0.66, 1.00)	1	HR 1.18 (0.59, 2.39)	1	HR 0.65 (0.33, 1.27)
Malmir et al (2020)	Hip	10	RR 0.93 (0.75, 1.15)		-		-
	Hip	9	OR 0.75 (0.57, 0.99)*		-		-
Hidayat et al (2020)	Hip	9	RR 0.86 (0.73, 1.02)	4	RR 0.78 (0.68, 0.90)*	4	RR 0.85 (0.66, 1.08)
Ong et al (2020)	Hip		-	3	RR 0.76 (0.63, 0.80)*	2	RR 0.89 (0.73, 1.10)

* $p<0.05$

Rizzoli R, Biver E, Brennan-Speranza TC. *Lancet Diabetes Endocrinol.* 2021 Sep;9(9):606-621.

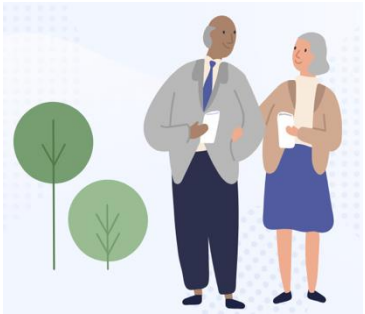
Meta-analysis of intervention studies with dairy products in postmenopausal women: BMD changes

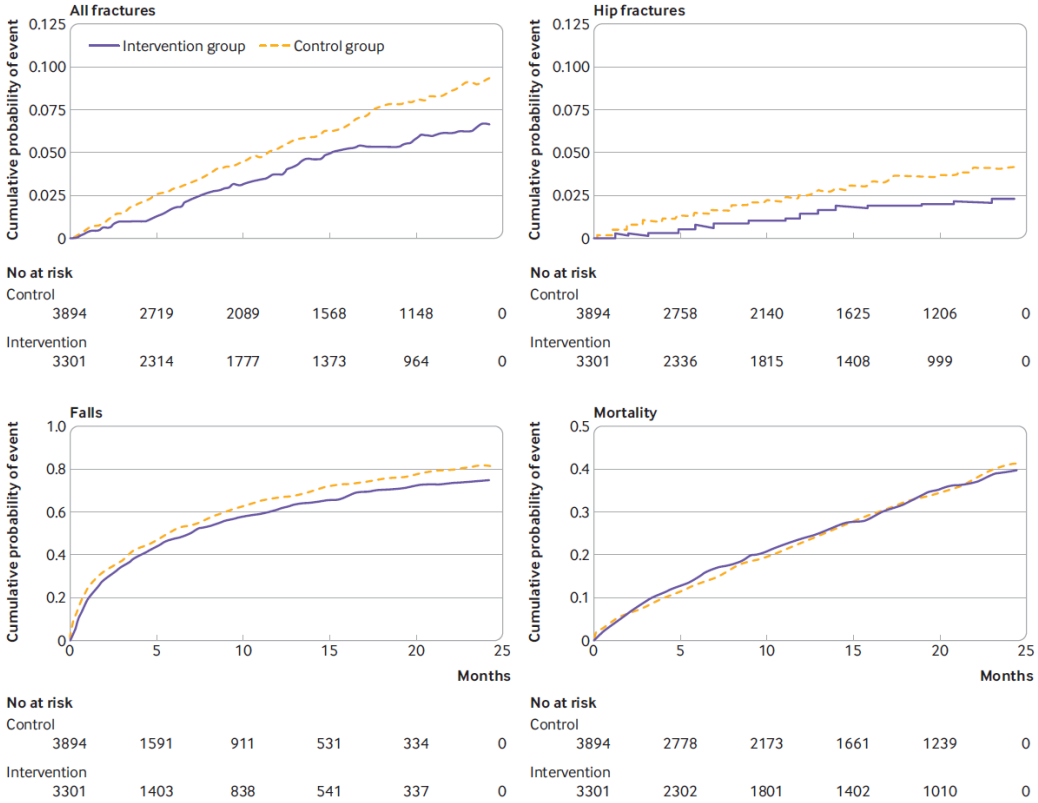
Study or Subgroup	Experimental Mean	SD	Total	Control Mean	SD	Total	Weight	Std. Mean Difference IV, Fixed, 95% CI
1.1.1 Lumbar spine								
Chee 2003	0.04	3.53	91	-0.87	3.71	82	28.0%	0.25 [-0.05, 0.55]
Gui 2012	-0.64	25.1	41	-1.59	19.06	24	9.9%	0.04 [-0.46, 0.54]
Lau 2001	-0.56	2.83	95	-1.5	2.75	90	29.8%	0.34 [0.05, 0.63]
Manious 2007	2	4.81	39	-0.8	12.54	36	12.1%	0.30 [-0.16, 0.75]
Prince 1995	0.38	0.65	42	0.51	3.56	42	13.7%	-0.05 [-0.48, 0.38]
Storm 1998	1.39	7.56	20	0.5	3.58	20	6.5%	0.15 [-0.47, 0.77]
Subtotal (95% CI)			**328**			**294**	**100.0%**	**0.21 [0.05, 0.37]**
Heterogeneity: Chi² = 2.82, df = 5 (P = 0.73); I² = 0%								
Test for overall effect: Z = 2.63 (P = 0.009)								
1.1.2 Femoral neck								
Chee 2003	0.53	4.01	91	-1.2	3.62	82	31.7%	0.45 [0.15, 0.75]
Gui 2012	2.81	29.58	41	-3.64	21.75	24	11.3%	0.24 [-0.27, 0.74]
Lau 2001	0.7	4.97	95	-1.1	2.85	90	34.0%	0.44 [0.15, 0.73]
Prince 1995	-0.13	3.82	42	-1.49	2.79	42	15.5%	0.40 [-0.03, 0.84]
Storm 1998	-1.77	5.68	20	-0.25	7.29	20	7.5%	-0.23 [-0.85, 0.39]
Subtotal (95% CI)			**289**			**258**	**100.0%**	**0.36 [0.19, 0.53]**
Heterogeneity: Chi² = 4.32, df = 4 (P = 0.36); I² = 7%								
Test for overall effect: Z = 4.19 (P < 0.0001)								
1.1.3 Total hip								
Chee 2003	-0.47	4.29	91	-2.2	3.62	82	34.2%	0.43 [0.13, 0.73]
Gui 2012	2.54	23.31	41	-1.11	26.11	24	12.3%	0.15 [-0.36, 0.65]
Lau 2001	-0.06	2.14	95	-0.88	2.47	90	36.9%	0.35 [0.06, 0.64]
Prince 1995	0.06	3.11	42	-1.39	3.24	42	16.6%	0.45 [0.02, 0.89]
Subtotal (95% CI)			**269**			**238**	**100.0%**	**0.37 [0.20, 0.55]**
Heterogeneity: Chi² = 1.06, df = 3 (P = 0.79); I² = 0%								
Test for overall effect: Z = 4.13 (P < 0.0001)								
1.1.4 Total body								
Chee 2003	0.04	1.81	91	-0.8	1.81	82	40.8%	0.46 [0.16, 0.76]
Lau 2001	-0.32	1.56	95	-1.2	1.8	90	43.4%	0.52 [0.23, 0.81]
Manious 2007	1.5	2.25	39	-0.7	1.86	36	15.9%	1.05 [0.57, 1.54]
Subtotal (95% CI)			**225**			**208**	**100.0%**	**0.58 [0.39, 0.77]**
Heterogeneity: Chi² = 4.36, df = 2 (P = 0.11); I² = 54%								
Test for overall effect: Z = 5.90 (P < 0.00001)								



Shi Y et al. *Arch Osteoporos*. 2020 Mar 18;15(1):48.

Supplementation with dairy products reduces the incidence of falls and fractures in institutionalized elderly subjects

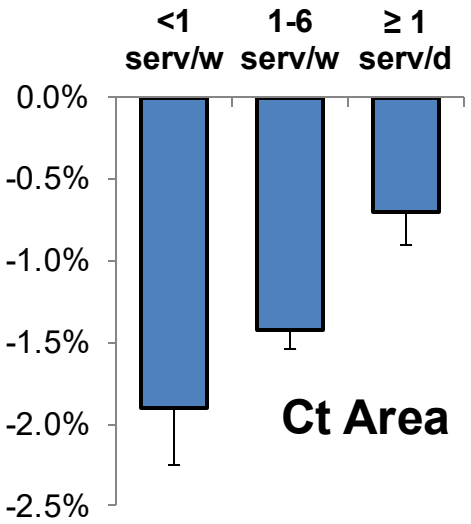




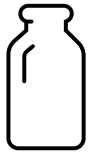
Iuliano S et al. BMJ. 2021 Oct 20;375:n2364.

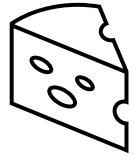
Dairy products and bone loss during ageing

Fermented dairy products consumption



Annual change (%) of radius cortical area





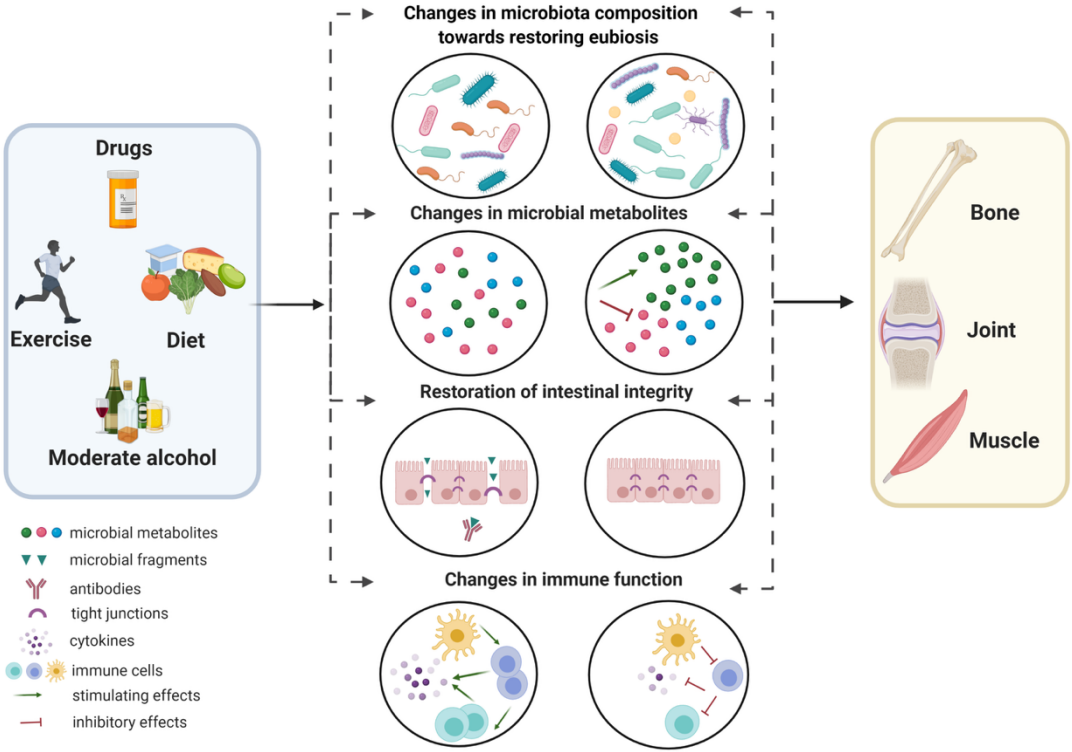
→ not with milk or ripened cheese

→ Fermented dairy products consumption is associated with attenuated post-menopausal bone loss

- Better **calcium balance** (Parathyroid hormone)
- Lower **bone resorption** (beta-crosslaps)
- independently of total energy, calcium, or protein intakes.

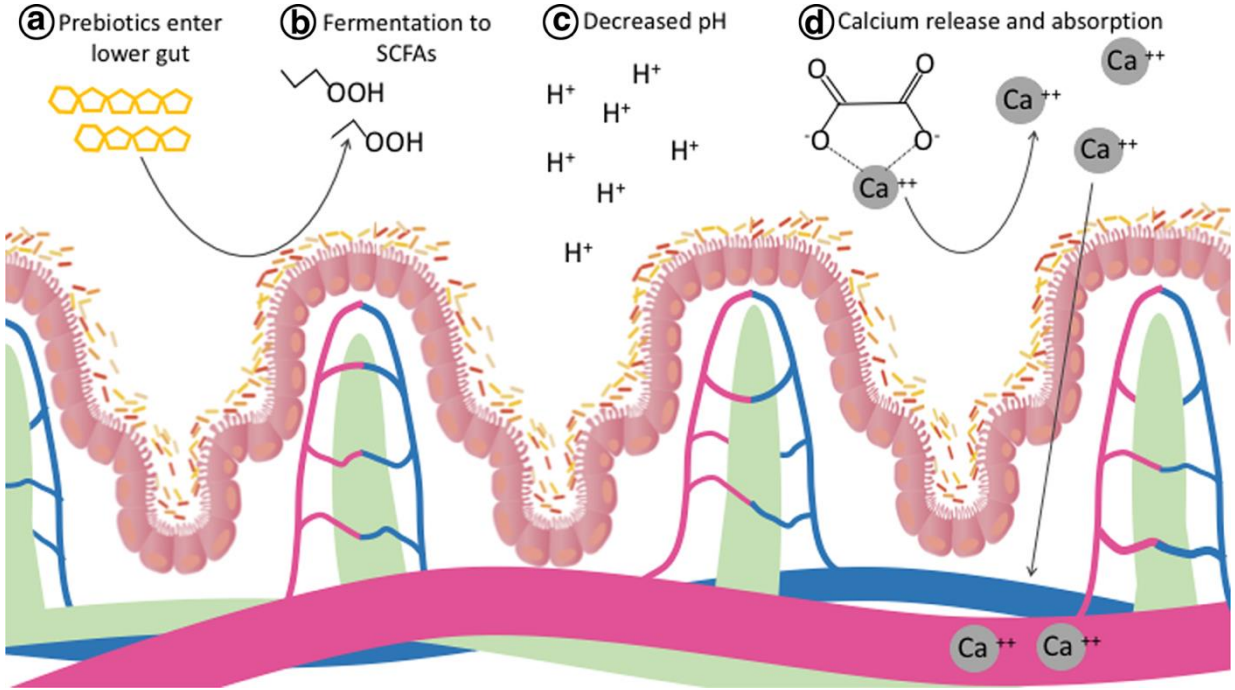
Biver E et al, *Osteoporos Int.* 2018 Aug;29(8):1771-1782.

Why fermented dairy products?



Papageorgiou M & Biver E. *Ther Adv Musculoskelet Dis.* 2021 Apr 20;13:1759720X211009018.
Biver E, et al. *Ageing Res Rev*. 2019 Nov;55:100946. c

Interaction microbiome - calcium balance



Whisner C, *Calcif Tissue Int* (2018) 102:443–479

Interactions microbiome-therapeutics in osteoporosis

The Journal of Clinical Investigation

J Clin Invest. 2020;130(4):1767–1781.

Parathyroid hormone–dependent bone formation requires butyrate production by intestinal microbiota

Jau-Yi Li,[1,2] Mingcan Yu,[1,2] Subhashis Pal,[1,2] Abdul Malik Tyagi,[1,2] Hamid Dar,[1,2] Jonathan Adams,[1,2] M. Neale Weitzmann,[1,2,3] Rheinallt M. Jones,[2,4,5] and Roberto Pacifici[1,2,5]

[1]Division of Endocrinology, Metabolism and Lipids, Department of Medicine, and [2]Emory Microbiome Center, Emory University, Atlanta, Georgia, USA. [3]Atlanta Department of Veterans Affairs Medical Center, Decatur, Georgia, USA. [4]Division of Pediatric Gastroenterology, Hepatology, and Nutrition, Department of Pediatrics, and [5]Immunology and Molecular Pathogenesis Program, Emory University, Atlanta, Georgia, USA.

And my cholesterol, doctor?

→ Risk of high total cholesterol per 300 mg intake of calcium from different sources.

Meta-analysis of 20 cohort studies (Companys J et al. *Adv Nutr.* 2020 Jul 1;11(4):834-863):

Consumption of **fermented dairy products**:

- 4% reduction in cardiovascular events
- 27% reduction in risk of type 2 diabetes
- 20% reduction in risk of metabolic syndrome

* Adjusted for age, sex, weight, height, smoking status, alcohol intake, dietary energy intake, physical activity energy expenditure and use of medication (statins or other lipid-lowering drugs, antihypertensive drugs, antidiabetic drugs). Results are expressed per 300 mg increase in Ca intake (quantity provided by one serving of dairy products).

Papageorgiou M et al. *Nutrients*. 2022 Mar 21;14(6):1314.

Sources of calcium: Serving Size / Calcium Content / Absorption

Food	Servings needed to equal 240 ml milk
Milk	1.0
Yogurt	1.0
Cheddar cheese	1.0
Tofu with calcium	1.2
Bok choy	2.3
Kale	3.2
Broccoli	4.5
Spinach	16.3
Red beans	9.7
White beans	3.9
Pinto beans	8.1
Rhubarb	9.5

=

240 g

85 g

Rozenberg, Calcif Tissue Int 2016

Plant-based drinks – Dairy alternatives fortified with Ca

Table 1 The nutritional profile of cow's milk and plant-based alternatives, with and without fortification (nutritional content per 100 mL of beverage)

	Milk	Soy drink	Soy drink, fortified	Almond drink	Rice drink	Rice drink, fortified	Oat drink	Oat drink, fortified
Energy, kcal	64	55	45	47	50	54	50	45
Energy, kJ	268	230	188	197	209	226	209	188
Protein, g	3.4	3.1	3.3	0.7	0.1	0.1	0.6	0.5
Total lipid, g	3.5	2.3	1.9	2.2	0.9	0.9	1	1.6
Carbohydrate, g	4.9	5.3	3.6	5.9	10.3	11.4	9.7	7.2
Vitamin A, RE	35.3	0	0	0	0	0	0.34	0
Vitamin B_2, mg	0.18	0.01	0.02	0.02	0	0	0.01	0.01
Vitamin B_{12}, µg	0.39	0	NA	NA	NA	NA	NA	NA
Calcium, mg	119.0	9.86	74.5	8.8	1.85	84.3	6.56	126.0
Zinc, mg	0.36	0.25	0.28	0.11	0.03	0.05	0.41	0.08
Iron, mg	0.02	0.45	0.50	0.12	0.01	0.23	0.03	0.44
Iodine, µg	16.5	1.3	9.35	0.89	1.04	2.5	0.418	5.9
Phosphorus, mg	91.0	44.1	41.5	14.3	7.39	28.0	13.2	16.9

Data from the Danish National Food Institute [34]

Geiker, N. R. W., et al. Osteoporosis International 31.4 (2020): 601-615.

Mineral waters, another source of calcium

- Tap water contains between 50 and 100 mg/l calcium.
- The absorption of Ca from Ca-rich mineral waters is comparable to that of milk and Ca supplements.

Savoir plus – manger mieux sge-ssn.ch

Teneur en calcium des eaux minérales

Les eaux minérales sont classées par ordre décroissant en fonction de leur teneur en calcium (mg par litre).

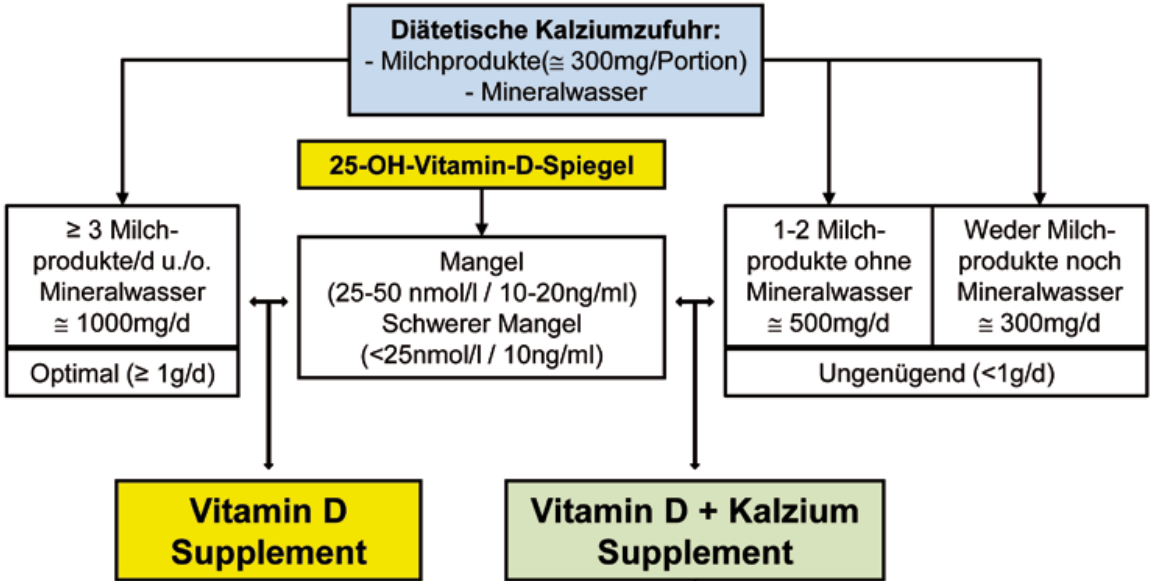
Adelbodner	Adello	Eptinger	Valser (St. Peters-quelle)	Aproz	Aquella (Bouillets)	Rhäzünser	Cristallo (Lostorf)
579	530	510	435	360	300	230	221

Passugger (Theophilquelle)	San Pellegrino	Badoit (St.Galmier)	Cristalp (Saxon)	Elmer	Appenzell (Gotenbad)	Allegra (Malix)	Henniez
211	164	153	115	118	108	100	104

Vichy-Célestins	Valais (Montis)	Knutwiler	Arkina	Evian (Cachat)	Valser Silence (St. Paulsquelle)	Zurzacher	Volvic
103	90	89	85	80	54	16	12

Source: Association suisse des sources d'eaux minérales et des producteurs de soft drinks, 2017
Statut: Septembre 2019, sous réserve de modifications

Calcium-vitamin D supplements?



Biver E. 06 _ 2018 _ der informierte arzt

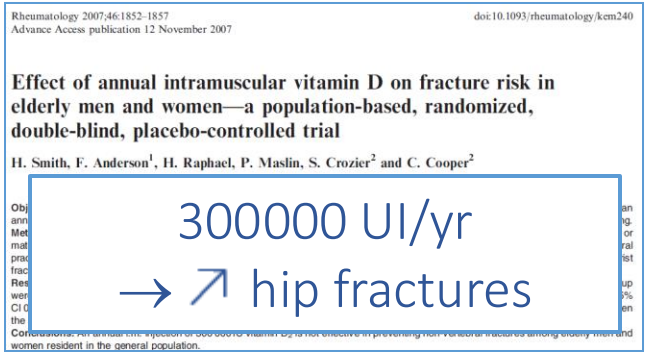
Suppléments de vitamine D

Lundeos	caps molles		20000 UI
VitaCaps	caps molles		24000 UI
Vitamine D3 Sandoz eco	caps molles		1000 UI
Vitamin D3 Spirig HC	caps molles		800 UI
Vitamine D3 Sandoz eco	caps molles		3200 UI
Vitamine D3 Streuli	caps molles		20000 UI
Vitamine D3 Sandoz eco	caps molles		25000 UI
Vi-De 3 4500 UI/ml	sol buv alcool	gouttes	100 UI/goutte
Dibase 10000 UI/ml	sol buv huileuse	gouttes	200 UI/goutte
Vitamine D3 Wild 20000 UI/ml	sol buv huileuse	gouttes	500 UI/goutte
Vitamin D3 Spirig HC 2740 UI/ml	sol buv huileuse	gouttes	67 UI/goutte
Dibase	sol buv huileuse	monodose	25000 UI
Viferol D3	sol buv huileuse	monodose	25000 UI
Viferol D3	sol buv huileuse	monodose	100000 UI
Vicrin D3	sol buv	monodose	100000 UI
Vitamine D3 Streuli	sol inj	monodose	300000 UI
Vi-De 3 dose par mois	sol buv alcool	monodose	24000 UI
Vitamine D3 Streuli Prophylax	sol buv huileuse	pipette	4000 UI/ml
Vitamine D3 Streuli pour thérapie	sol buv huileuse	pipette	4000 UI/ml
LuVit D3 pour la prévention	sol buv huileuse	pipette	4000 UI/ml
LuVit D3 pour le traitement	sol buv huileuse	pipette	4000 UI/ml

Suppléments de calcium –vitamine D

Calcimagon D3 Forte	cp croquer	1000/800
Calcimagon D3	cp croquer	500/800
Calcimagon D3	cp croquer	500/400
Calcium D3 Sandoz	pdr	500/440
Calcium D3 Sandoz	pdr	1000/880
Calcium D3 Mepha	cp eff	1200/800
Calcium D3 Sandoz	cp croquer	500/1000
Calcium D3 Sandoz	cp croquer	500/440
Calperos D3	cp sucer	500/400
Kacipos D3	cp pell	500/800
Natecal D	cp orodisp	600/400
Osteocal D3	cp eff	1200/800

High doses of vitamin D should not be used in elderly partients



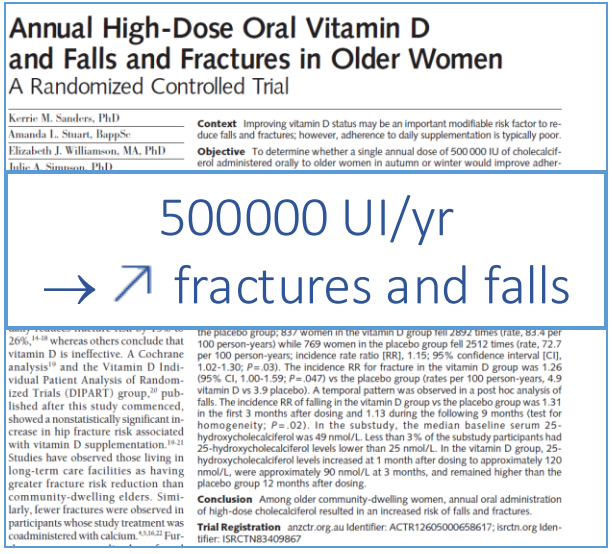
Rheumatology 2007;46:1852–1857 doi:10.1093/rheumatology/kem240
Advance Access publication 12 November 2007

Effect of annual intramuscular vitamin D on fracture risk in elderly men and women—a population-based, randomized, double-blind, placebo-controlled trial

H. Smith, F. Anderson[1], H. Raphael, P. Maslin, S. Crozier[2] and C. Cooper[2]

women resident in the general population.

300000 UI/yr
→ ↗ hip fractures



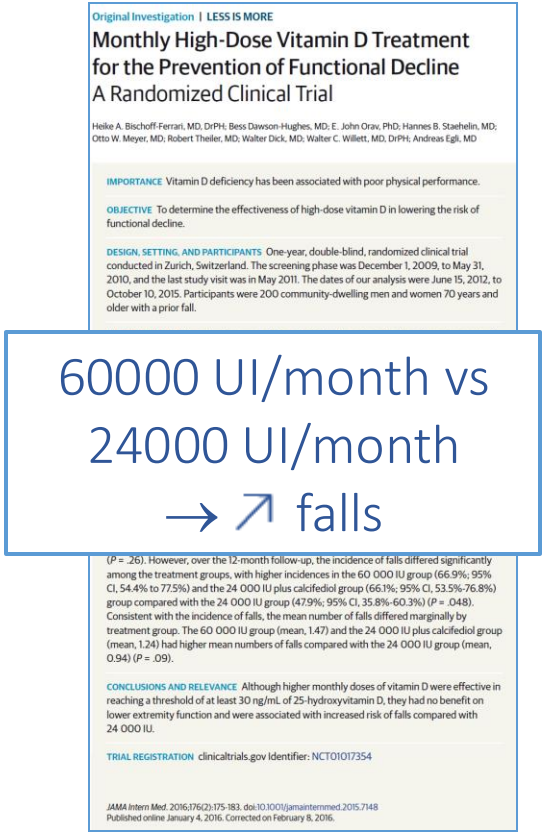
Annual High-Dose Oral Vitamin D and Falls and Fractures in Older Women
A Randomized Controlled Trial

Kerrie M. Sanders, PhD
Amanda L. Stuart, BappSc
Elizabeth J. Williamson, MA, PhD
Julie A. Simpson, PhD

Context Improving vitamin D status may be an important modifiable risk factor to reduce falls and fractures; however, adherence to daily supplementation is typically poor.

Objective To determine whether a single annual dose of 500 000 IU of cholecalciferol administered orally to older women in autumn or winter would improve adher-

500000 UI/yr
→ ↗ fractures and falls



Original Investigation | LESS IS MORE

Monthly High-Dose Vitamin D Treatment for the Prevention of Functional Decline
A Randomized Clinical Trial

Heike A. Bischoff-Ferrari, MD, DrPH; Bess Dawson-Hughes, MD; E. John Orav, PhD; Hannes B. Staehelin, MD; Otto W. Meyer, MD; Robert Theiler, MD; Walter Dick, MD; Walter C. Willett, MD, DrPH; Andreas Egli, MD

IMPORTANCE Vitamin D deficiency has been associated with poor physical performance.

OBJECTIVE To determine the effectiveness of high-dose vitamin D in lowering the risk of functional decline.

DESIGN, SETTING, AND PARTICIPANTS One-year, double-blind, randomized clinical trial conducted in Zurich, Switzerland. The screening phase was December 1, 2009, to May 31, 2010, and the last study visit was in May 2011. The dates of our analysis were June 15, 2012, to October 10, 2015. Participants were 200 community-dwelling men and women 70 years and older with a prior fall.

60000 UI/month vs
24000 UI/month
→ ↗ falls

CONCLUSIONS AND RELEVANCE Although higher monthly doses of vitamin D were effective in reaching a threshold of at least 30 ng/mL of 25-hydroxyvitamin D, they had no benefit on lower extremity function and were associated with increased risk of falls compared with 24 000 IU.

TRIAL REGISTRATION clinicaltrials.gov Identifier: NCT01017354

JAMA Intern Med. 2016;176(2):175-183. doi:10.1001/jamainternmed.2015.7148
Published online January 4, 2016. Corrected on February 8, 2016.

Fracture risk according to diet

	Fracture risk	
	Hip	All fractures
Vegan diet	+131%	+44%
Unbalanced Western diet	/	+10%
Vegetarian diet	0* à +25%	0 à +10%
Omnivore Diet	Référence	Référence
Mediterranean diet	-21%	/

/ no data; * No significant ↗ in risk among semi-vegetarians, pesco-vegetarians and lacto-ovo-vegetarians. Adapted from Malmir H et al. Eur J Nutr. 2018;57(6):2147-60; Denova-Gutiérrez E et al. Nutrients. 2018;10(12); Iguacel I et al. Nutr Rev. 2019;77(1):1-18; Tong TYN et al. BMC Med. 2020;18(1):353; Thorpe DL et al. Am J Clin Nutr. 2021;114(2):488-95.

Beverages and osteoporosis

- **Soft drinks**

→ Associated with lower BMD and increased risk of fractures starting with consumption of 1 to 2 soft drinks per day.

- **Coffee**

→ Associated with lower BMD and increased risk of fractures with consumption of more than 3 to 4 cups per day.

- **Tea**

→ Associated with higher BMD and decreased risk of fractures

- **Alcohol**

→ Established risk factor for osteoporosis

You should take an osteoporosis medications

I take vitamines and supplements Doctor …

Vitamines and osteoporosis

Recommendation [C – low level of evidence] "Except in the case of vitamin D, there is not enough scientific evidence to recommend supplementation with other vitamins to improve bone health"

- Vitamins (excluding D) are provided by the diet or synthesized by food sources (AA, bacteria, etc.).
- Some risk factors for osteoporosis are associated with a risk of vitamins deficiency.
- Numerous potential confounding factors exist in studies investigating associations between consumption of vitamin-rich foods/vitamin levels and BMD/fractures.
- Very few intervention studies, mostly with vitamin K, but with numerous biases.

Biver E et al. *Joint Bone Spine.* 2023 May;90(3):105521.

Revue du Rhumatisme 2023; 90: 405–425
en ligne sur / on line on
www.em-consulte.com/revue/rhuma
www.sciencedirect.com

Recommandations

Recommandations alimentaires dans le cadre de la prévention et du traitement de l'ostéoporose☆

Emmanuel Biver [1], Julia Herrou [2], Guillaume Larid [3], Mélanie A. Legrand [4,5], Sara Gonnelli [6], Cédric Annweiler [7], Roland Chapurlat [4,5], Véronique Coxam [8], Patrice Fardellone [9], Thierry Thomas [10], Jean-Michel Lecerf [11], Bernard Cortet [12], Julien Paccou [12]

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Mots clés
Nutrition
Régime alimentaire
Densité minérale osseuse
Ostéoporose
Fractures

Résumé

Cet article présente les recommandations initiales de la Société française de rhumatologie (SFR) et du Groupe de recherche et d'information sur les ostéoporoses (GRIO) concernant le rôle de l'alimentation dans la prévention et le traitement de l'ostéoporose. Ces recommandations ont été élaborées par un groupe de travail constitué de rhumatologues, de médecins nutritionnistes et d'un gériatre. Quinze (15) questions issues de la pratique quotidienne ont été présélectionnées. Pour la revue de la littérature, le groupe de travail s'est concentré sur les effets de l'alimentation

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* Ne pas utiliser, pour citation, la référence française de cet article mais la référence anglaise de *Joint Bone Spine* avec le DOI ci-dessus.

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Recommendations and metaanalyses

Dietary recommendations in the prevention and treatment of osteoporosis

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ABSTRACT

Introduction: This article presents the initial recommendations of the French Rheumatology Society (*Société Française de Rhumatologie* – SFR) and the Osteoporosis Research and Information Group (*Groupe de Recherche et d'Informations sur les Ostéoporoses* – GRIO) on the role of diet in the prevention and treatment of osteoporosis.
Methods: The recommendations were produced by a working group composed of rheumatologists, physician nutrition specialists and a geriatrician. Fifteen (15) questions pertaining to "daily practices" were preselected by the working group. For the literature review, the working group focussed mainly on the effects of diet on bone mineral density (BMD) and fractures, and primarily on meta-analyses of longitudinal studies and dietary intervention studies.
Results: A Mediterranean-type diet and the daily consumption of 2 to 3 dairy products are recommended. Together, these provide the calcium and "high quality" protein required to maintain a normal calcium-phosphorus balance and bone metabolism, and are associated with lower fracture risk. Conversely, unbalanced Western diets, vegan diets, weight-loss diets in non-overweight individuals, alcohol consumption and daily consumption of sodas are advised against. In terms of the beneficial effects on bone mineral density and fracture risk, current scientific data are either insufficient or too divergent to recommend increasing or restricting the consumption of tea or coffee, vitamins other than vitamin D, vitamin D-enriched or phytoestrogen-rich foods, calcium-enriched plant-based beverages, oral nutritional supplements, or dietary sources of prebiotics and probiotics.
Conclusions: These are the first set of recommendations addressing the role of diet in the prevention and treatment of osteoporosis. More research is necessary to direct and support guidelines.

1. Introduction

Dietary considerations are common among patients with osteoporosis. Additionally, a balanced diet is a major determinant of bone health. With the progress of scientific knowledge and changes in dietary habits – often influenced by contradictory messages that are a mixed bag of myths and actual scientific data –, new questions are emerging.

Nowadays, patients want more detailed information on the role of diet and diet regimens in the prevention and management of osteoporosis.

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1297-319X/

Dietary recommendations in the prevention and treatment of osteoporosis

Recommended:	Neutral recommendations (insufficient data):	Recommendations to avoid:
• Mediterranean diet • Dairy products (2 to 3/day) especially fermented • Mineral water rich in calcium if calcium intake is insufficient • Proteins (at least 1-1.2 g/kg/day)	• Tea • Coffee • Vitamins other than D • Vitamin D-fortified foods as an alternative to supplements • Calcium-fortified plant-based drinks as an alternative to dairy products • Oral nutritional supplements • Pre- and probiotics • Phytoestrogens	• Unbalanced “Western diet” • Vegan diets without calcium supplementation • Weight loss diets in the absence of overweight • Alcohol • Sodas

Biver E et al. *Joint Bone Spine.* 2023 May;90(3):105521.

Consultation with a dietician dedicated to nutrition and bone health (Jan 2022 -)

Patient characteristics

- Digestive disorders leading to a restrictive diet (lactose intolerance, irritable bowel syndrome…) 1/2
- Loss of weight/appetite, malnutrition… 1/3
- Eating disorders, orthorexia, compulsions… 1/3
- Metabolic disorders (dyslipidemia, hyperparathyroidism, metabolic syndrome…) 1/5
- Flexitarian, vegetarian, vegan diets 1/6
- Socioeconomic factors, addictions, cessation of physical activity 1/6
- …

Nutritional diagnoses

- Insufficient calcium intake 2/3
- Insufficient protein intake 1/2
- Insufficient energy intake 1/4
- Underweight/ unintentional weight loss 1/5
- …

Courtesy of Laurie Karsegard. Unpublished data presented at the 36e Journée genevoise de nutrition clinique 28.03.2024, work in progress

Take home messages

- Malnutrition impacts bone strength. Energy intake must be sufficient and appropriate to the level of physical activity
- A balanced diet rich in fruits and vegetables (5 portions/d), providing enough proteins (0.8 g/kg, up to 1.3 g/kg in malnourished elderly patients) and calcium (800-1000 mg/d) should be promoted for the prevention/treatment of bone fragility + physical activity, vitamin D, anti-osteoporotic drugs if needed.
- Fiber interferes with gut microbiota and modulate calcium absorption.
- Promote Mediterranean diet ++. Pay attention to vegan diet.
- Calcium and protein supplements should be adapted to dietary intake and comorbidities. No vitamins supplement, except vitamin D, is recommended to promote bone health.
- Personalized nutritional advice should be better defined to achieve adequate dietary intakes in the presence of medical conditions or personal choices that may compromise musculoskeletal health(e.g. plant-based diets…)