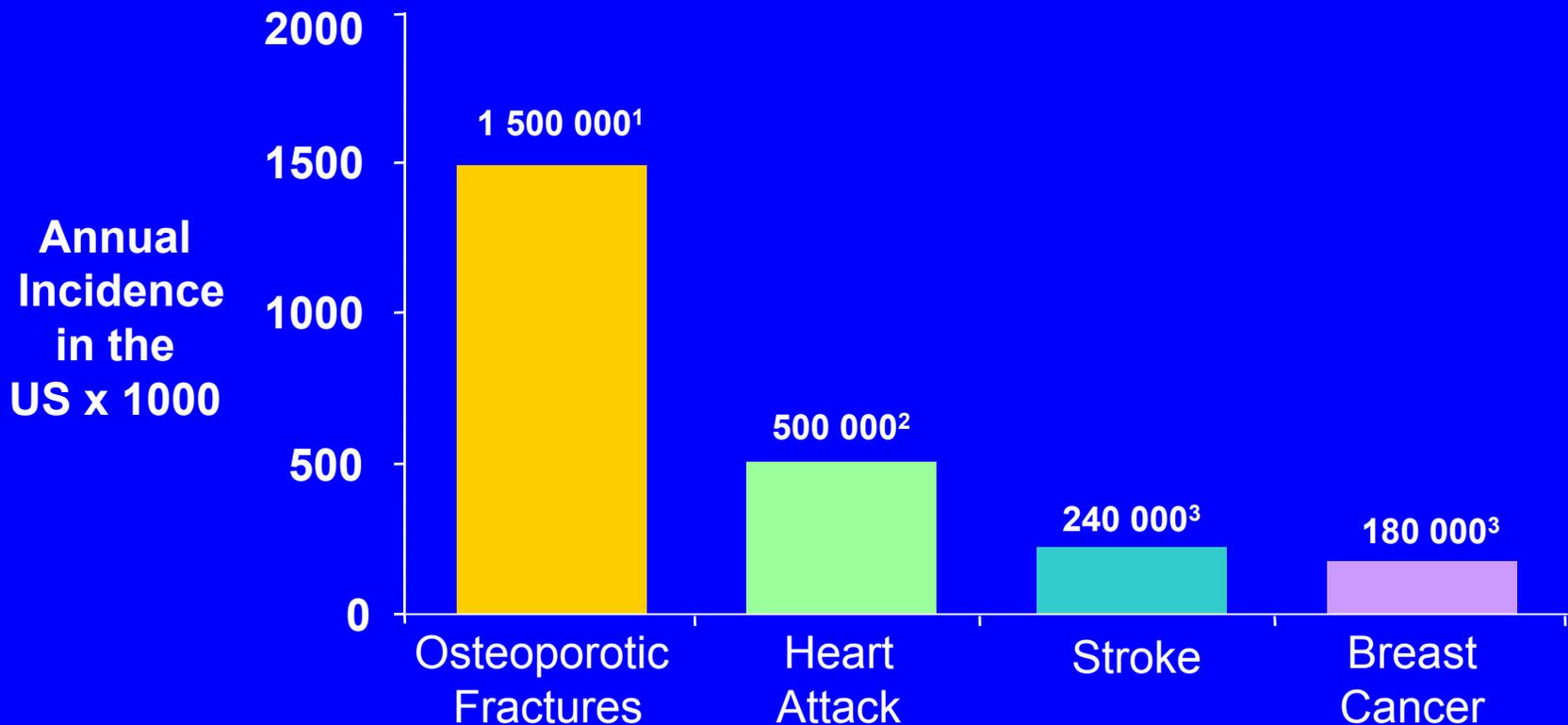


What is the Evidence for Supplement Use for Healthy Bones?

Osteoporotic Fractures in Women: Comparison With Other Diseases



¹Osteoporosis Fast Facts. National Osteoporosis Foundation. 2000.

²National Institutes of Health. *Healthy Heart Handbook for Women*. 2000.

³Statistical Information on Women and Women's Health. US Department of Health and Human Services. 2000.

Risk Factors for Osteoporosis

Lifestyle

- Poor diet
- Sedentary
- Thinness
- Smoking
- Alcohol
- Prior fracture

Hormonal

- Estrogen ↓
- Thyroid ↑
- Glucocorticoids ↑

Nutrients Related to Bone

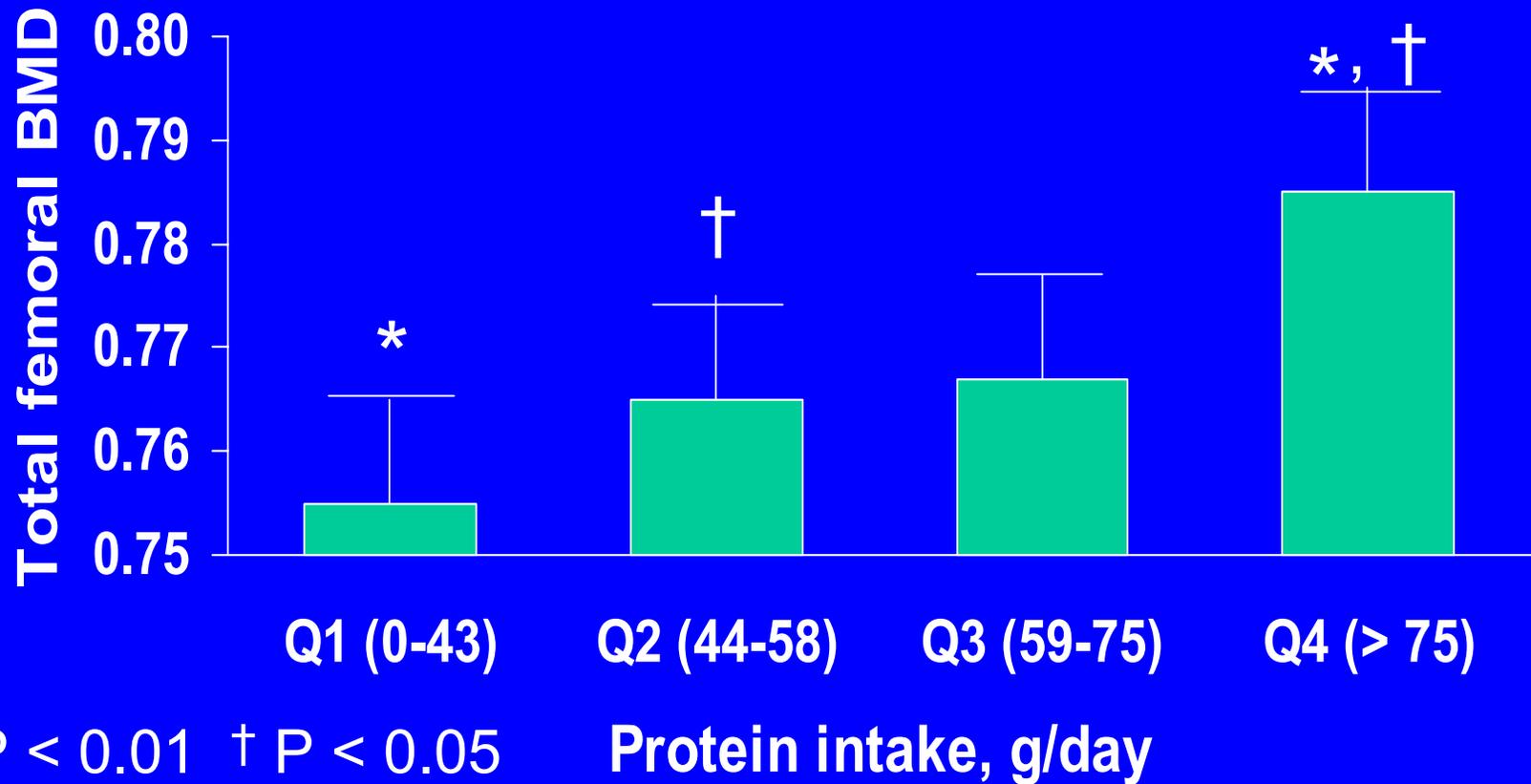
- Protein
- Vitamin K
- Calcium
- Vitamin D

Bone Composition

- Mineral - 70%
- Protein - 22%
- Water - 8%

Protein

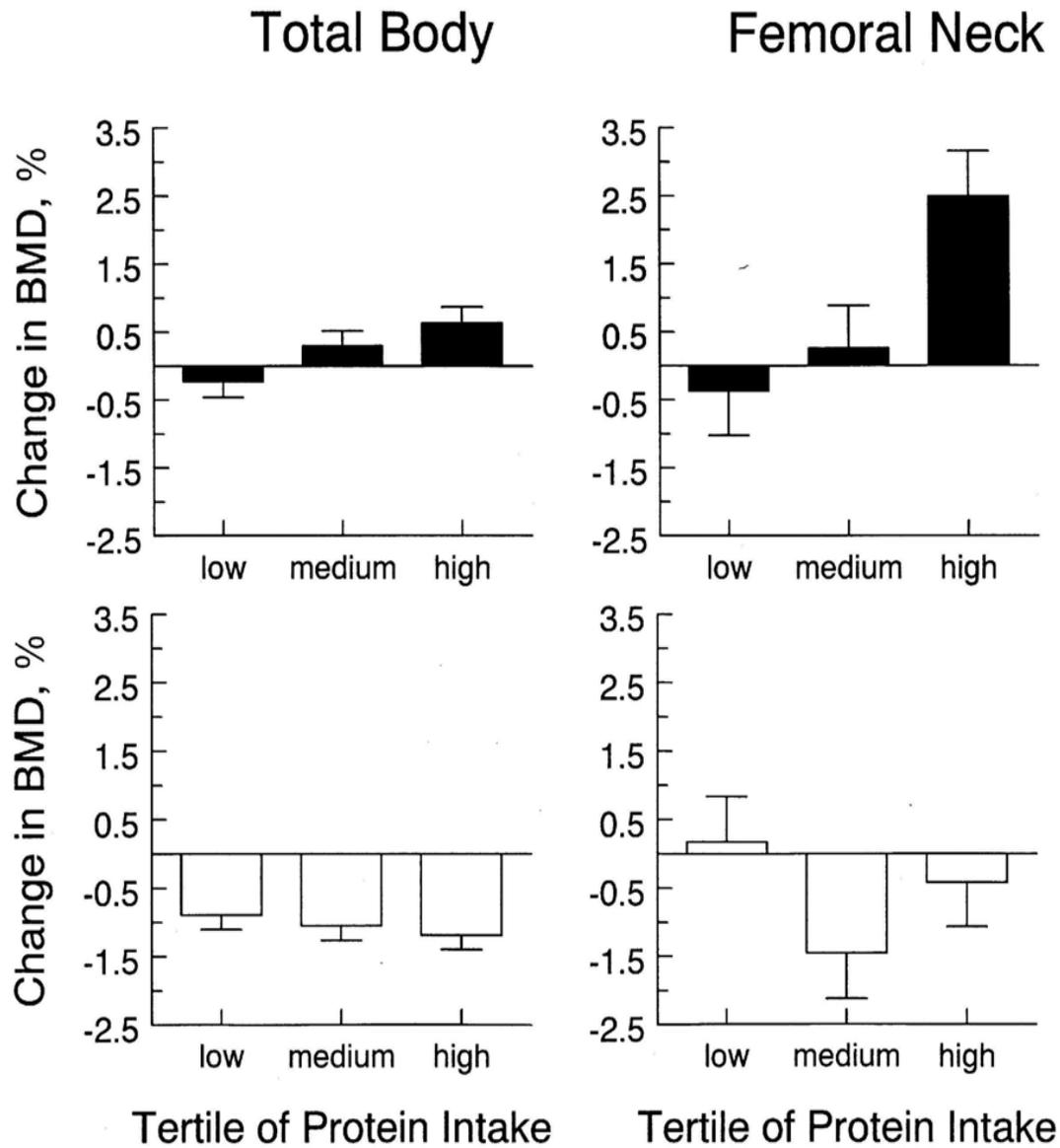
Protein Intake and Total Hip BMD in Caucasian Women (NHANES III)



Kerstetter JE. Calcif Tissue Int 2000; 66: 313.

Effects of Protein on Calcium Homeostasis

- Increases urine calcium losses
(1 gm dietary protein → 1 mg urinary calcium loss)
- Stimulates production of IGF-1, a bone growth factor



Dawson-Hughes B. Am J Clin Nutr 2002; 75: 773-9.

Vitamin K

Vitamin K

- Vitamin K is required for the formation of osteocalcin
- Osteocalcin is the most abundant noncollagenous protein in bone matrix
- Osteocalcin acts as a regulator of bone mineralization
- In vitamin K deficiency, undercarboxylated osteocalcin is produced
- Undercarboxylated osteocalcin may not function normally

Vitamin K Intake and Hip Fractures

Framingham Study 1988-1995

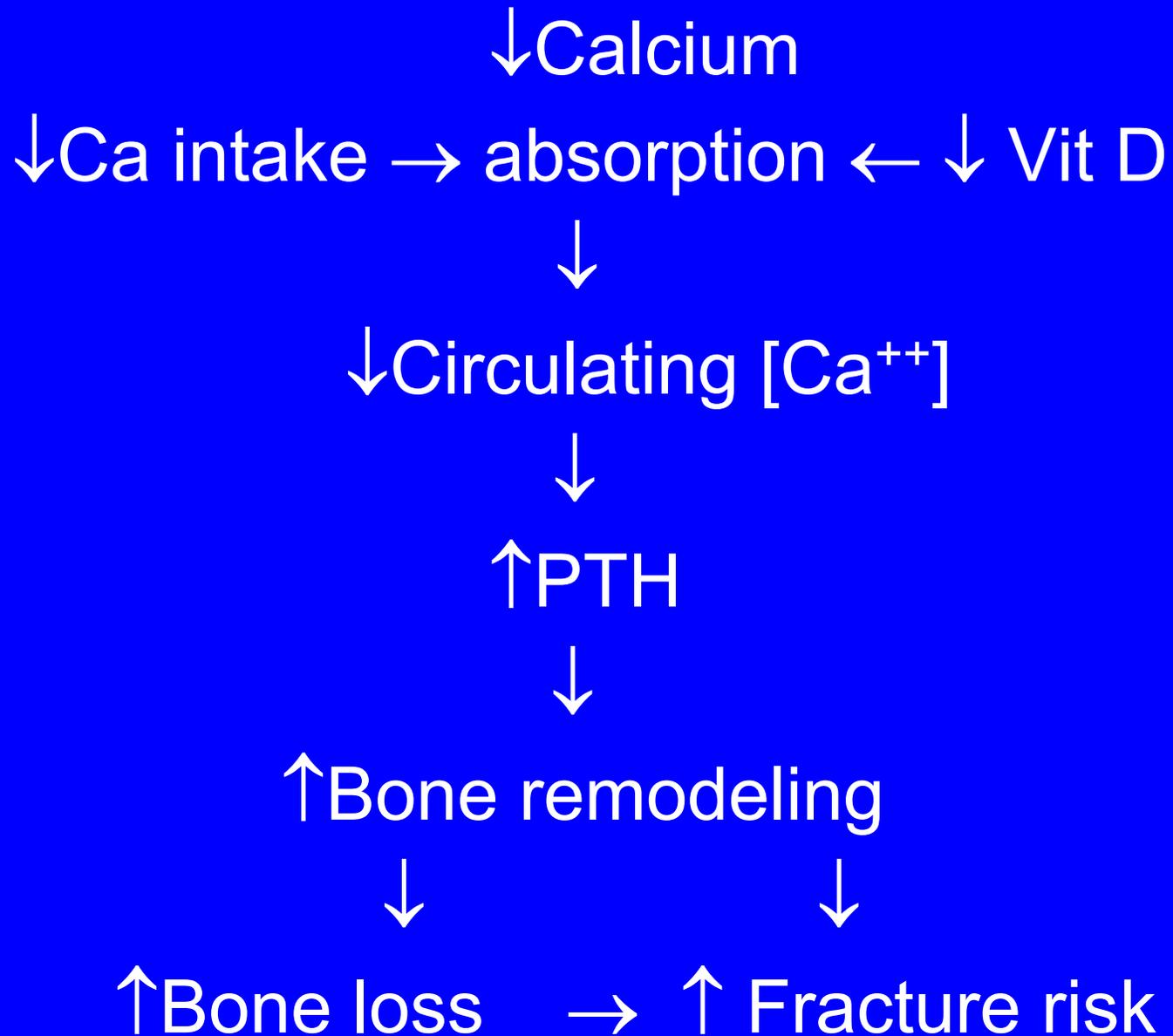
(888 subjects, 44 hip fractures)

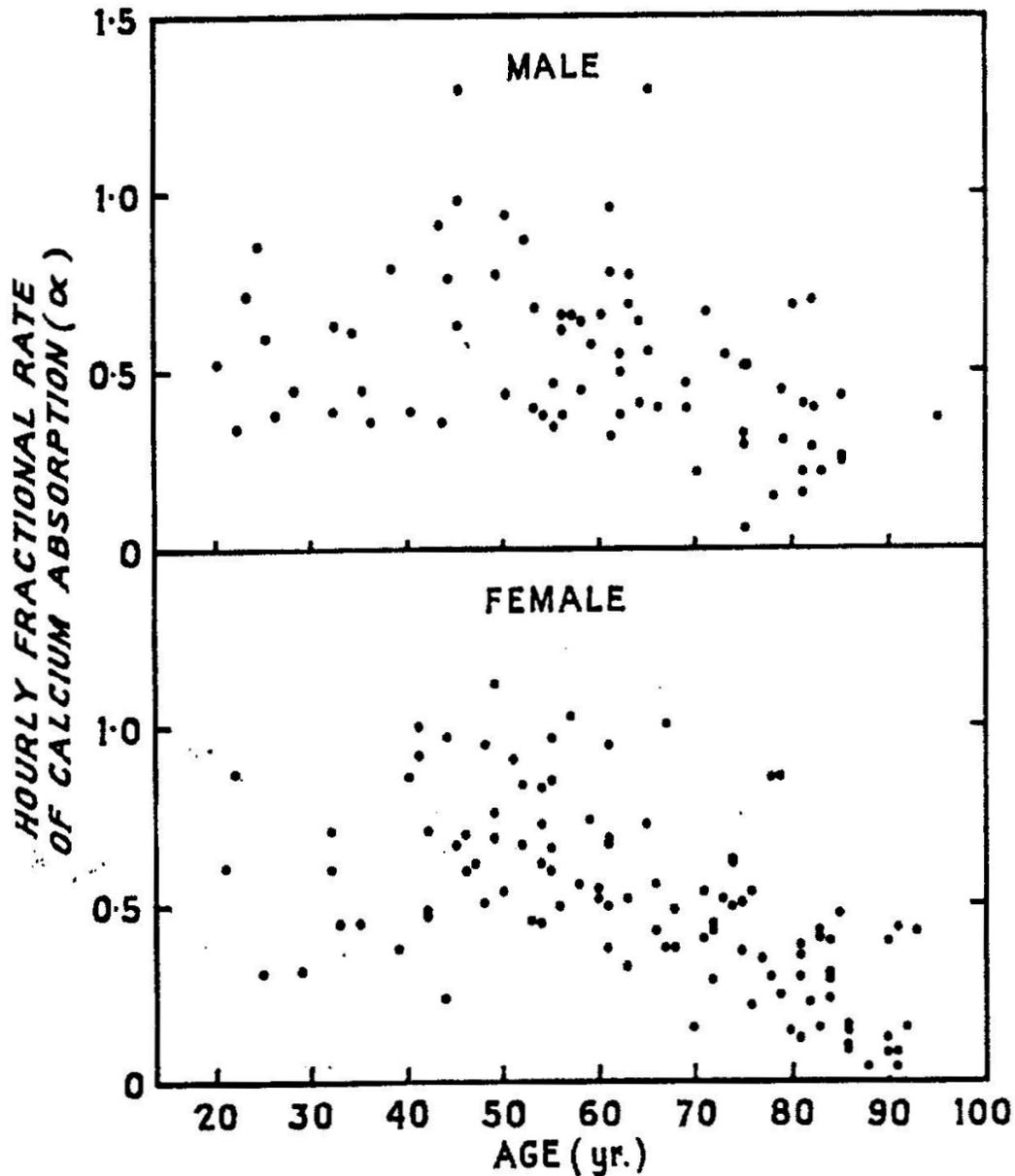
Q	Median vit K intake mcg/d	RR hip fracture	CI
1	56	1.0	
2	105	0.53	0.22, 1.28
3	156	0.59	0.25, 1.39
4	254	0.35	0.13, 0.94

P for trend = 0.047

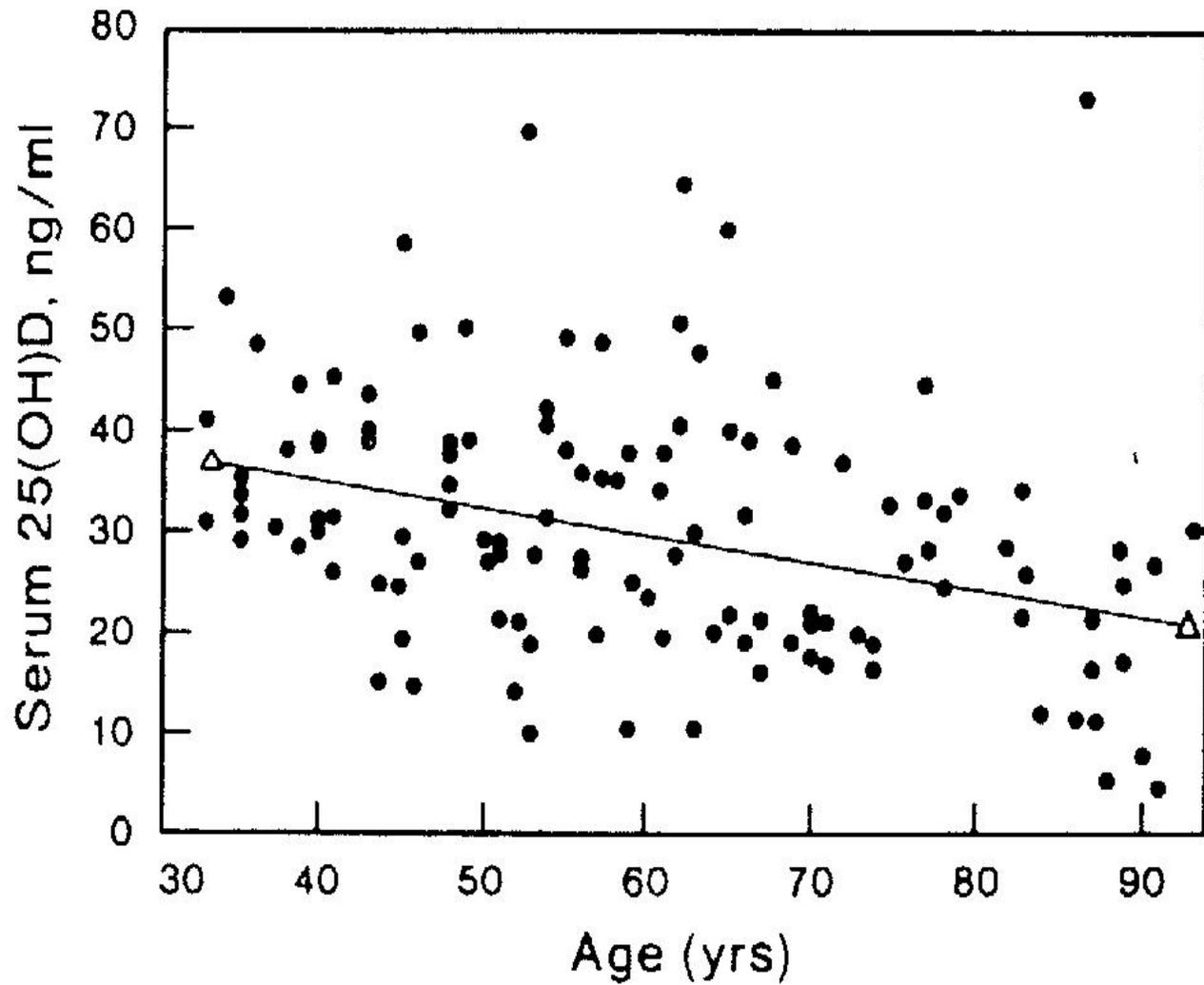
Booth SL, et al. Am J Clin Nutr 2000; 71: 1201-8.

Calcium and Vitamin D



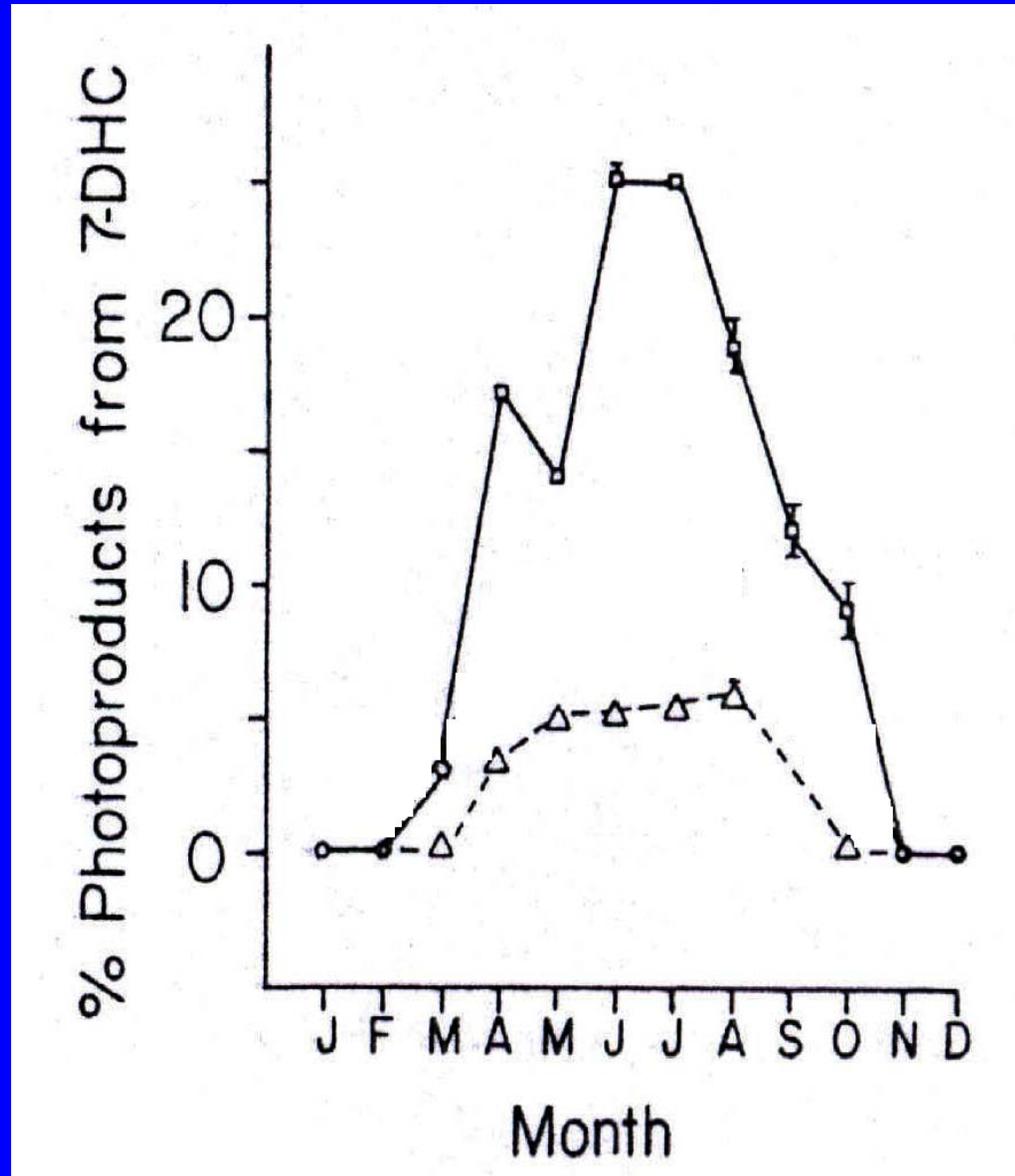


Bullamore R. Lancet 1970; 2: 535-7.

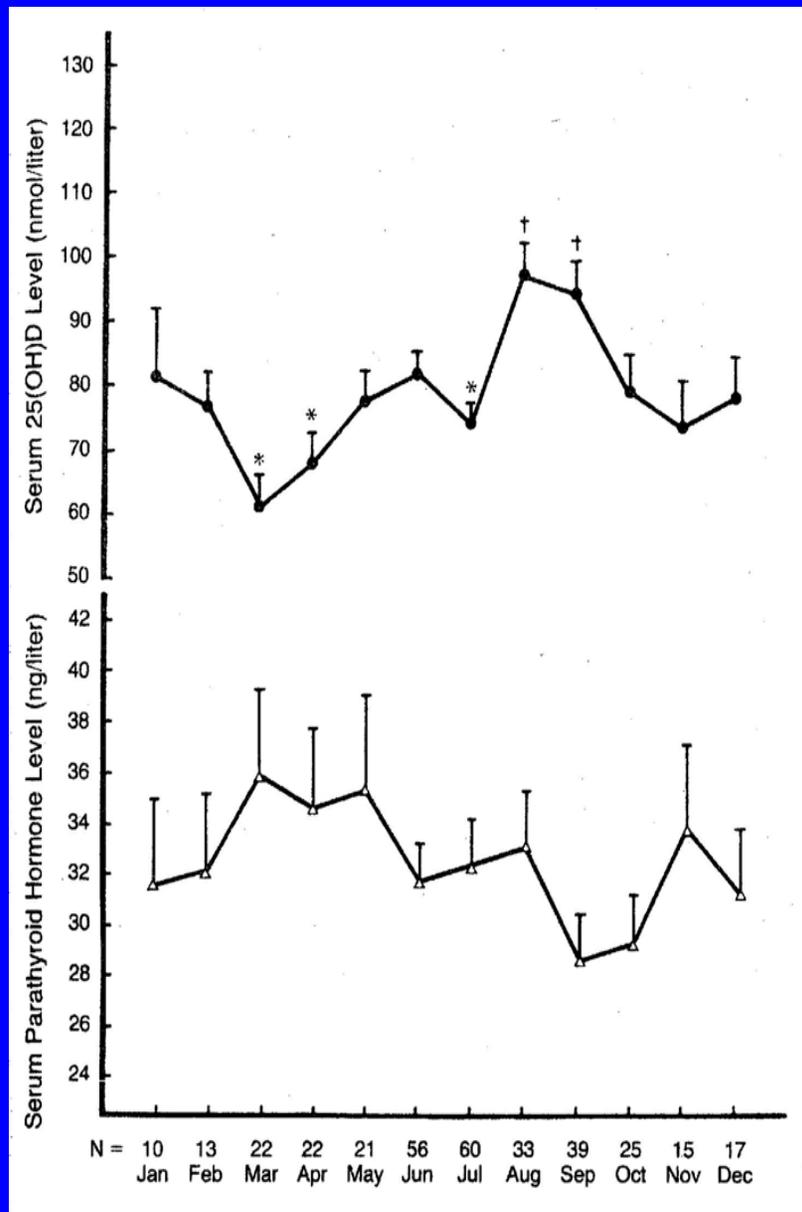


Tsai KS. Calcif Tissue Int 1987; 40: 241-3.

Vitamin D Synthesis By Season and Latitude



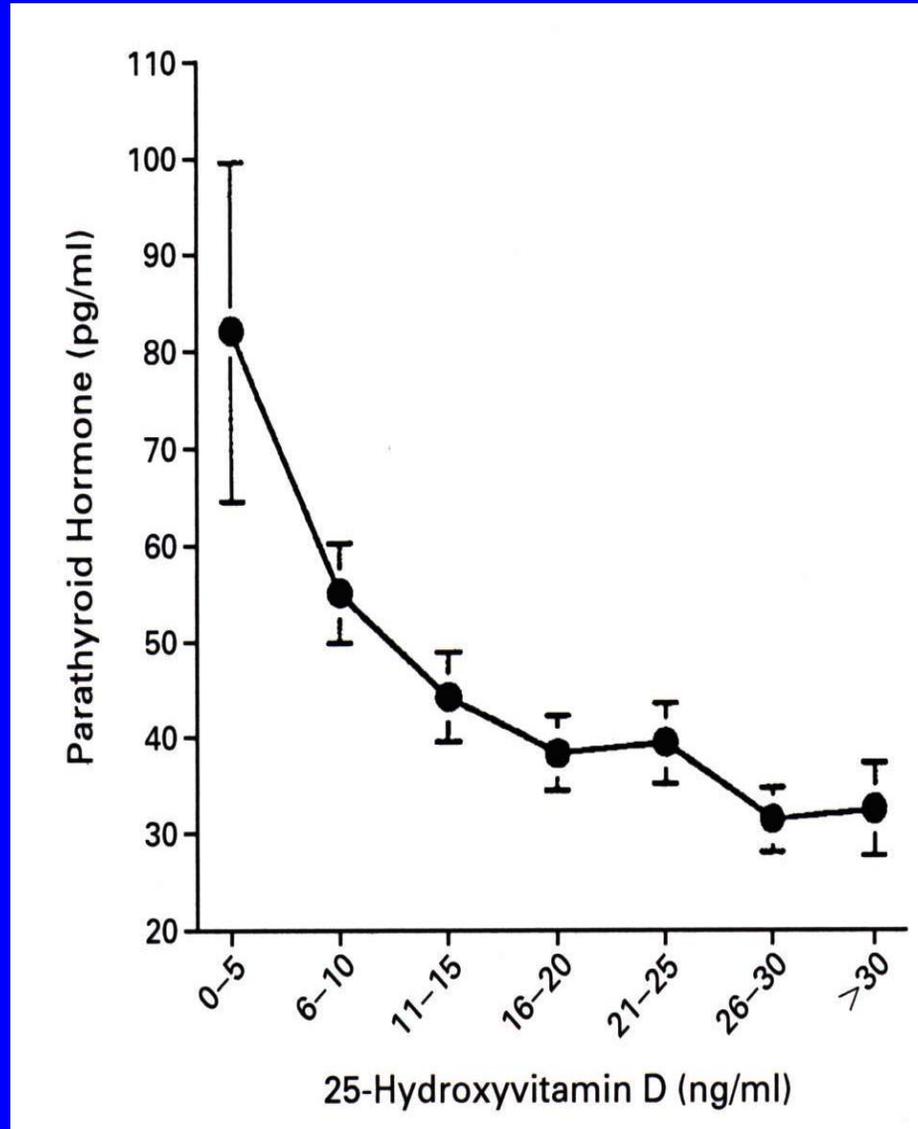
*Webb AR.
JCEM 1988;
67: 373-8.*



Krall EA. N Eng J Med 1989; 321: 1777-83.

What is the optimal 25(OH)D level?

The level that maximally suppresses PTH.



Thomas MK. N Eng J Med 1998; 338: 777-83.

25OHD Level Needed to Maximally Suppress PTH

- 30 nmol/L – Lips
- 50 nmol/L – Malabanan and Holick
- 75 nmol/L – Peacock
- 80 nmol/L – Meunier
- 90 nmol/L – Krall and Dawson-Hughes

Intervention Studies

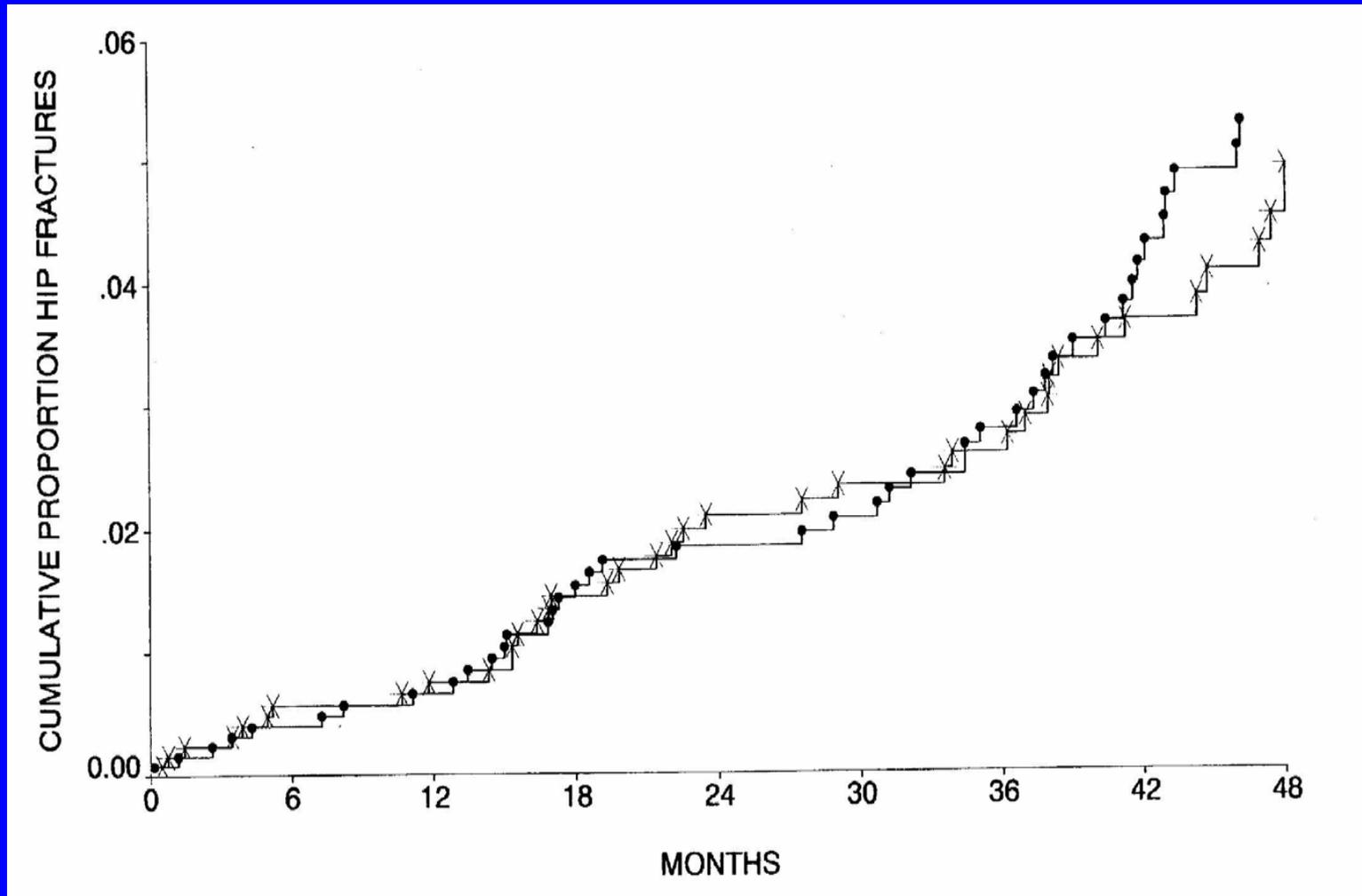
- Calcium
- Vitamin D
- Calcium + vitamin D

Calcium Intake and Fracture Incidence - Intervention Studies

Study	N	New Fracture Site	Significant reduction
Chevalley '94	18	vertebra	yes
Recker '96	61	vertebra	yes*
Reid '95	9	all sites	yes
Riggs '98	40	all sites	no

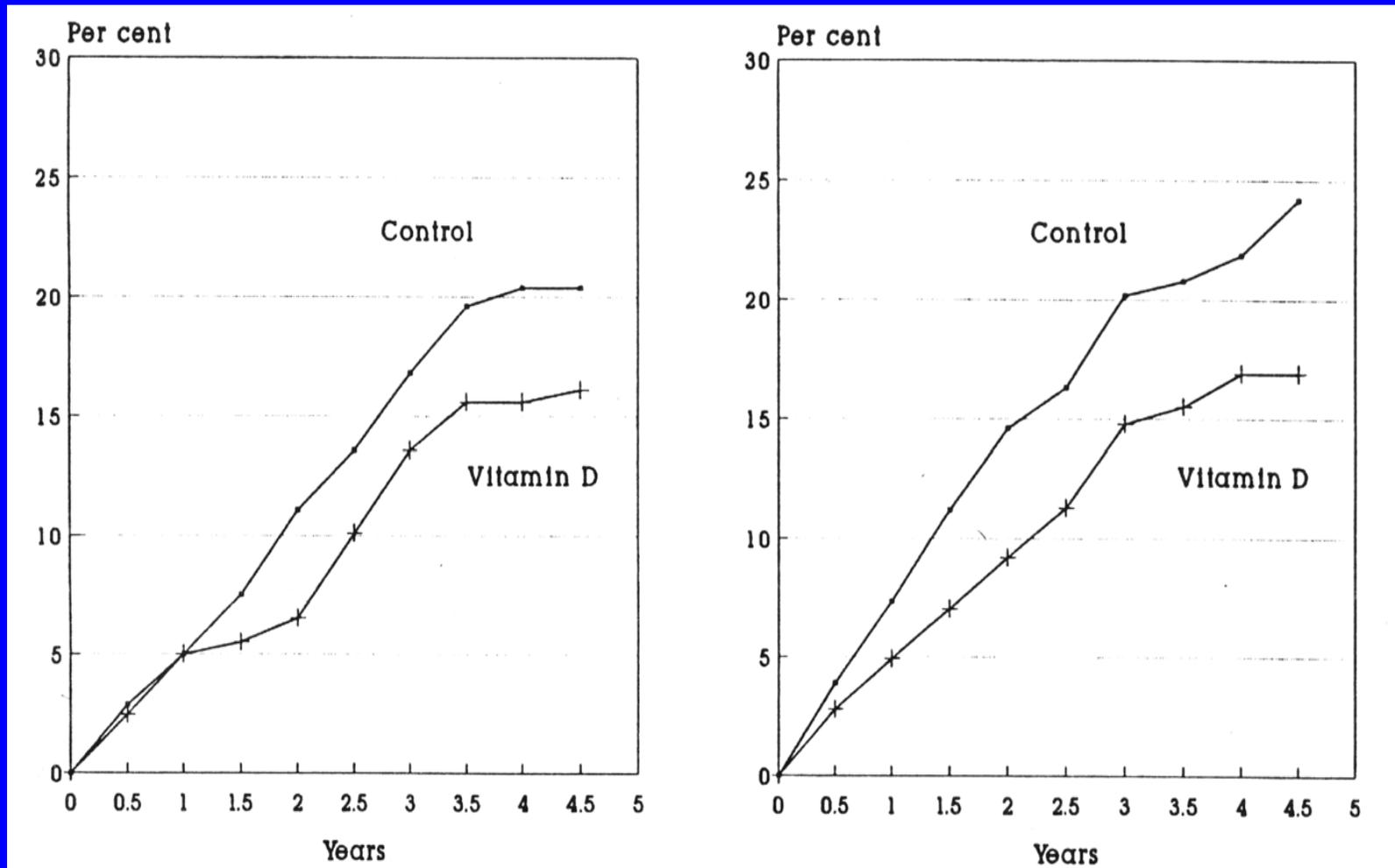
* In subset with prior fracture

Vitamin D (400 IU/d) Does Not Alter Hip Fracture Rates



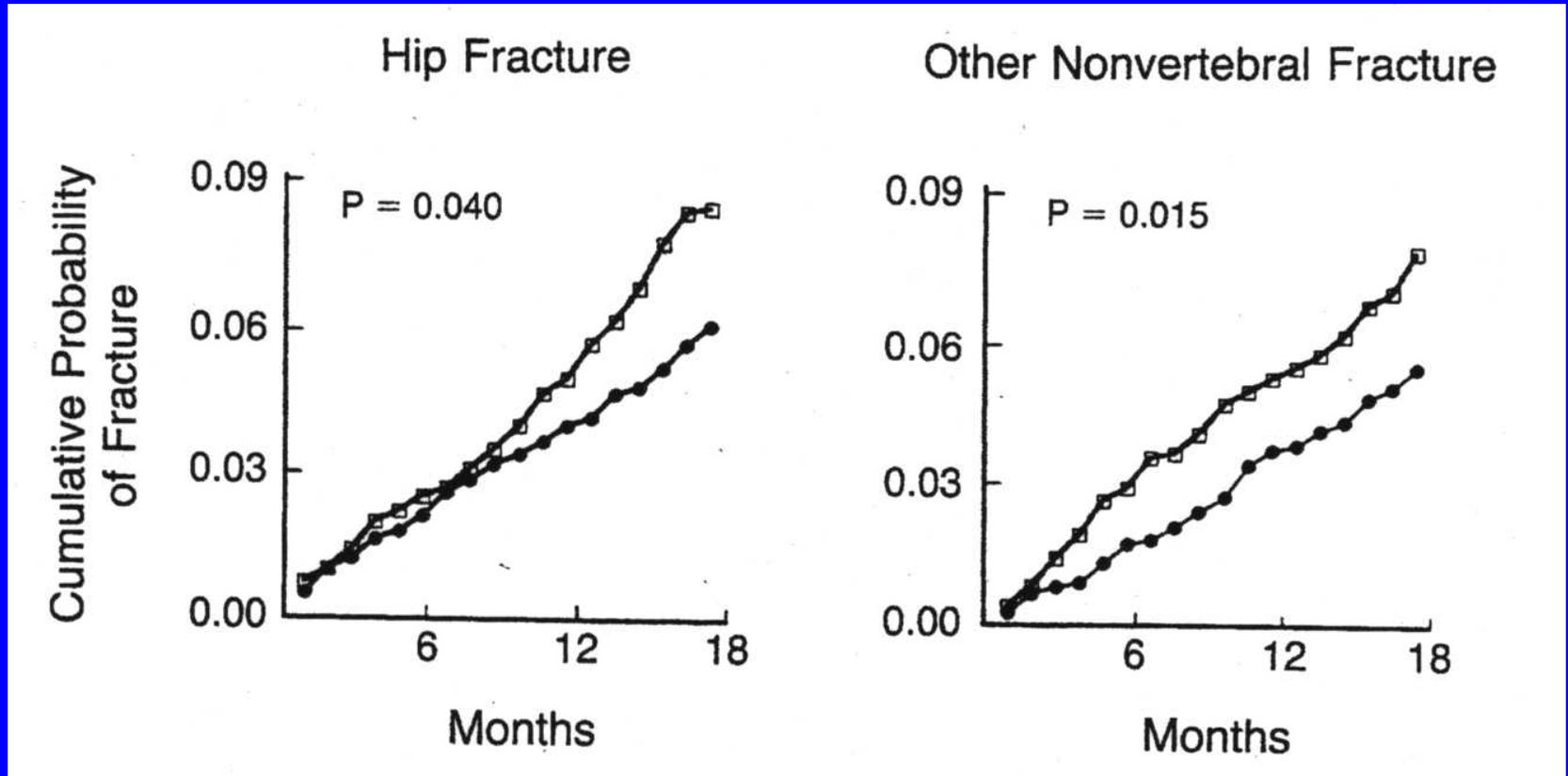
Lips P. Ann Intern Med 1996; 124: 400-6.

Intramuscular Vitamin D Lowers Clinical Fracture Rates



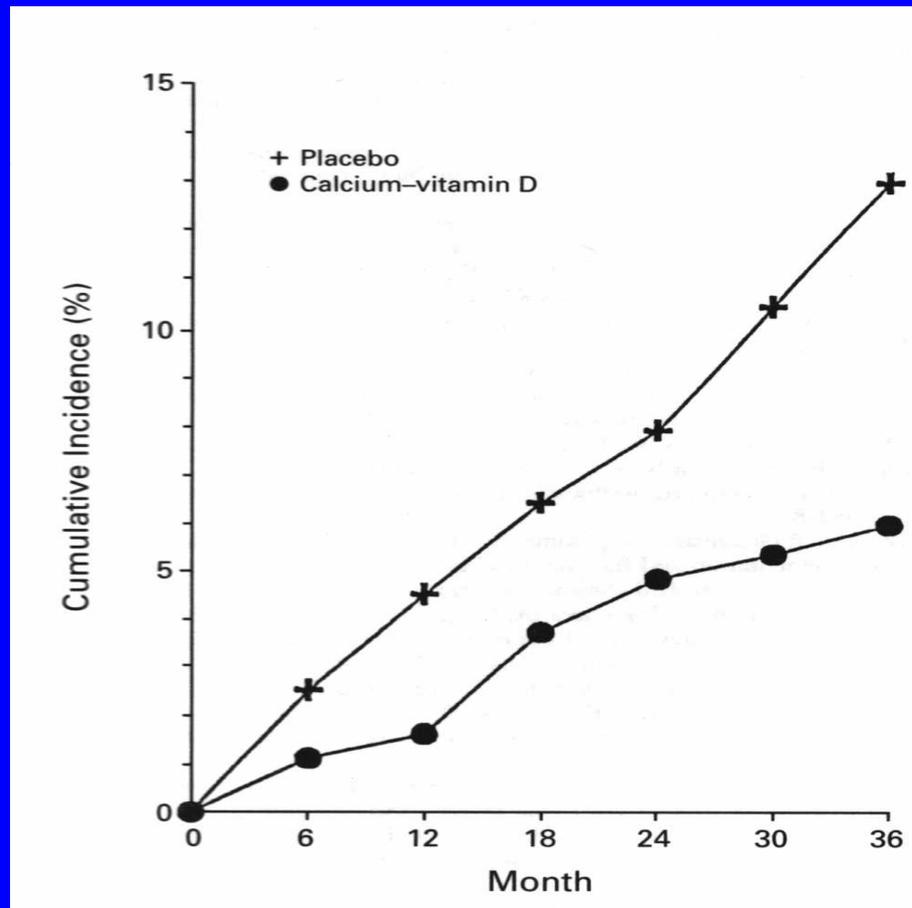
Heikinheimo RJ. Calcif Tissue Int 1992; 51: 105-10.

Effect of Calcium and Vitamin D on Fracture Rates in Very Elderly French Nursing Home Residents



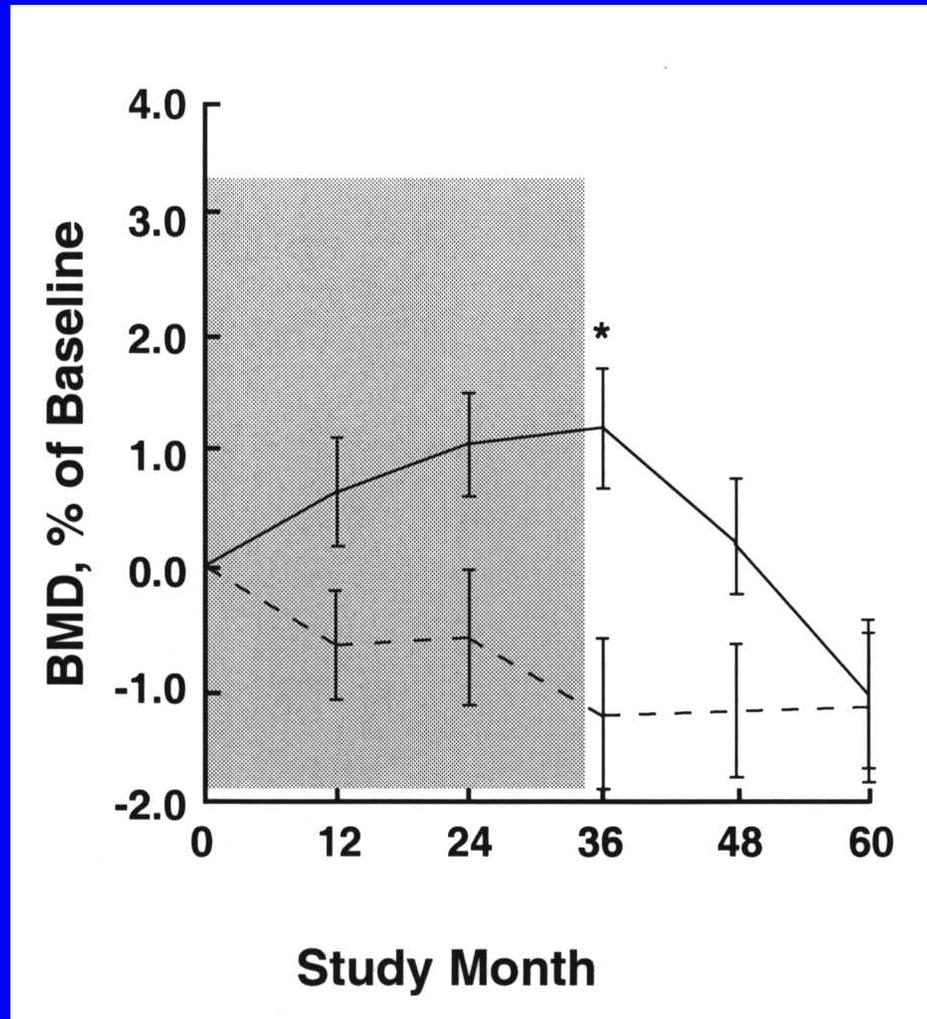
Chapuy MC. N Engl J Med 1992; 327: 1637-42.

Effect of Calcium and Vitamin D on Non-vertebral Fracture Rates in Healthy Men and Women



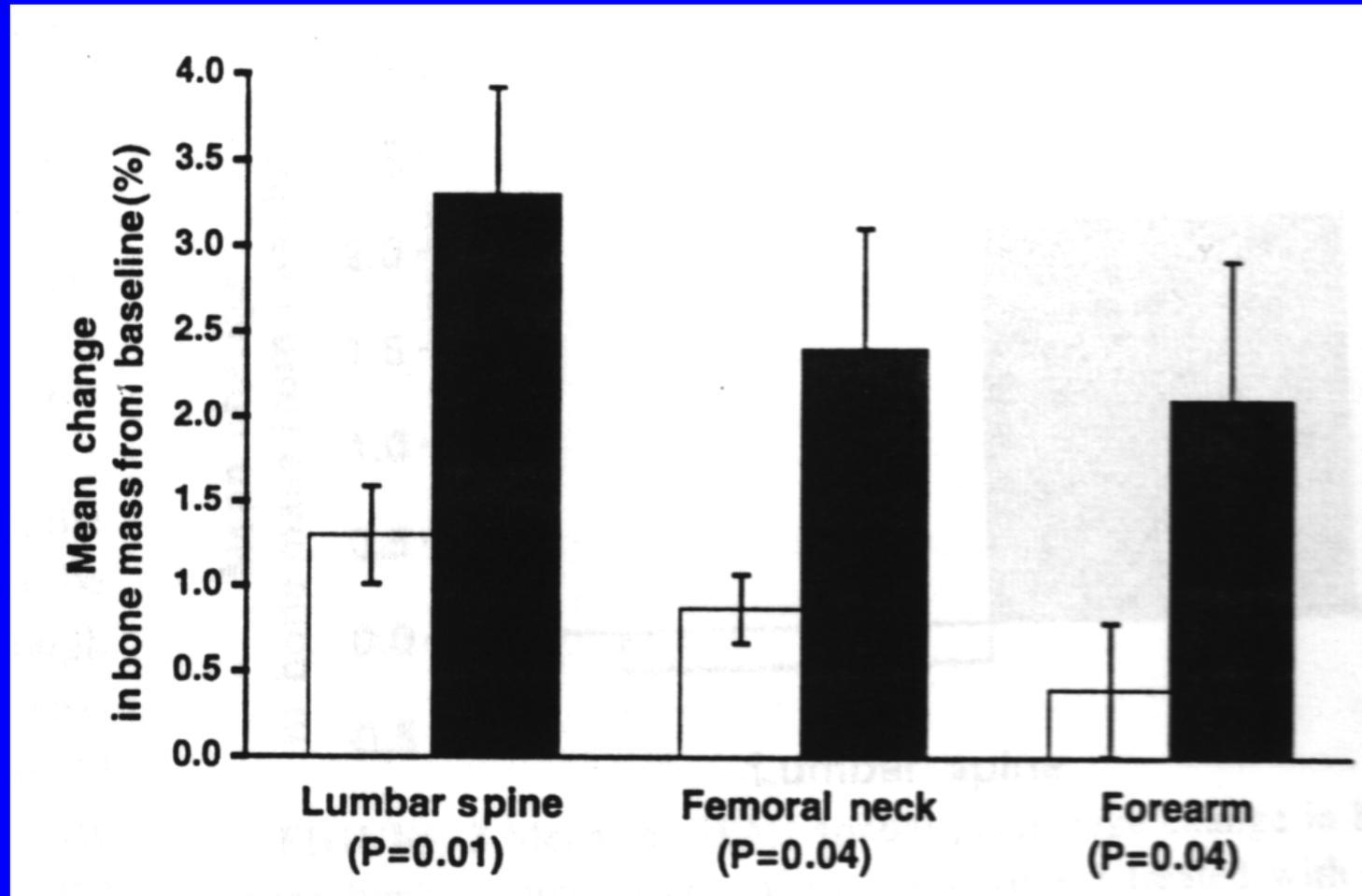
Dawson-Hughes B, et al. N Engl J Med 1997; 337:670-6.

Stopping Calcium and Vitamin D Supplements – Effect on Femoral Neck BMD in Men



Dawson-Hughes B. Am J Clin Nutr 2000; 72: 745-50.

Effect of Estrogen \pm Calcium on Change in BMD



Nieves JW. Am J Clin Nutr 1998; 67: 18-24.

Intake Recommendations for Men and Women

National Academy of Sciences

Age yrs	Calcium mg/d	Vitamin D IU/d
30-50	1000	200
51-70	1200	400
71+	1200	600

Percentage of U.S. Population Meeting NAS Requirements for Dietary Calcium

Group	Age	% meeting Ca requirement
Women	9 -18	<10
	19 - 30	<10
	31 - 50.1	<10
	51 - 70	<10
	71+	<1
Men	9 -18	25
	19 - 30	50
	31 - 50.1	25
	51 - 70	<10
	71+	5

Estimates based on 1994 CSFII data

Conclusions

- Dietary protein and vitamin K
 - roles needs further definition
 - amounts $>$ RDA may benefit bone
- Calcium and vitamin D
 - lower fracture rates in the elderly
 - dietary intakes are very low
 - supplements are needed