Current vitamin D status in Korea

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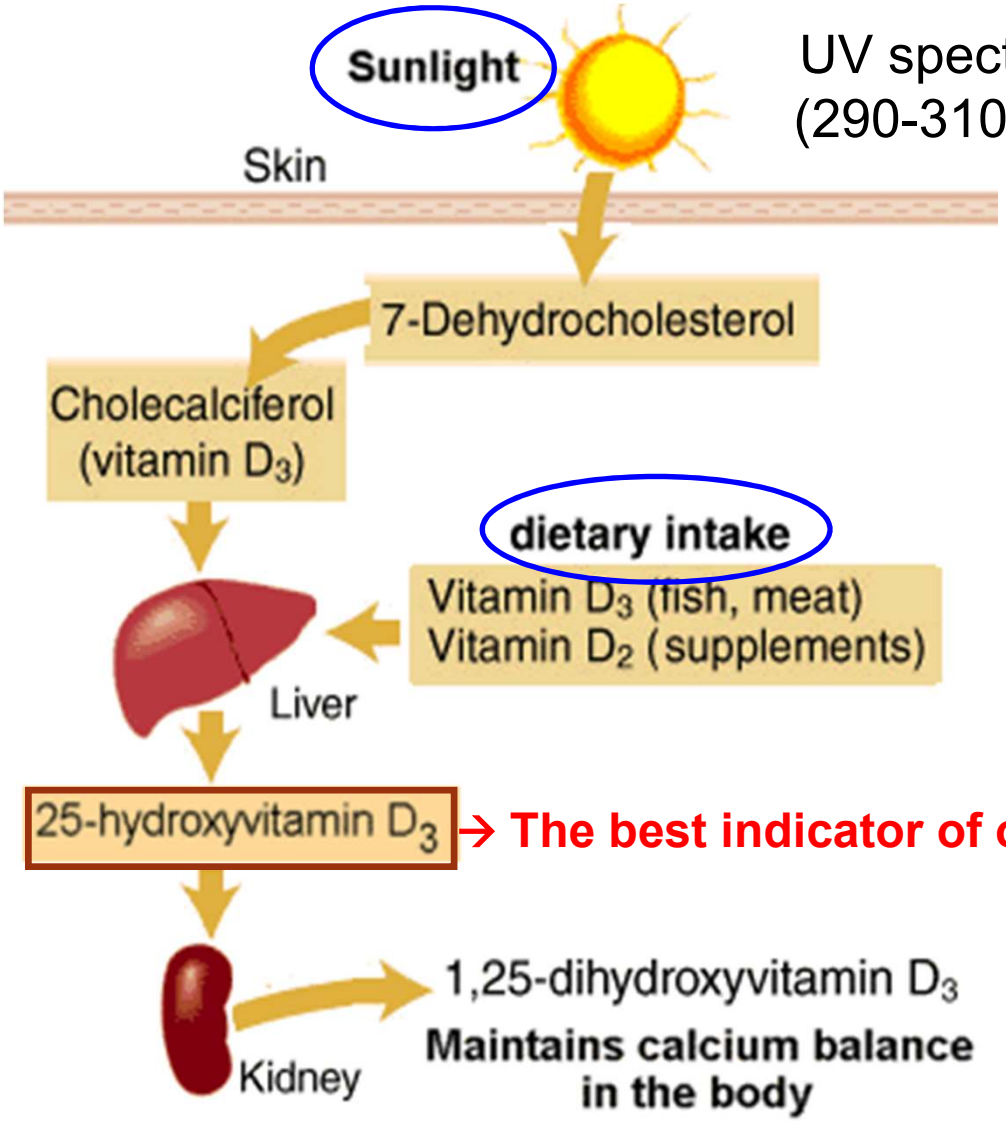
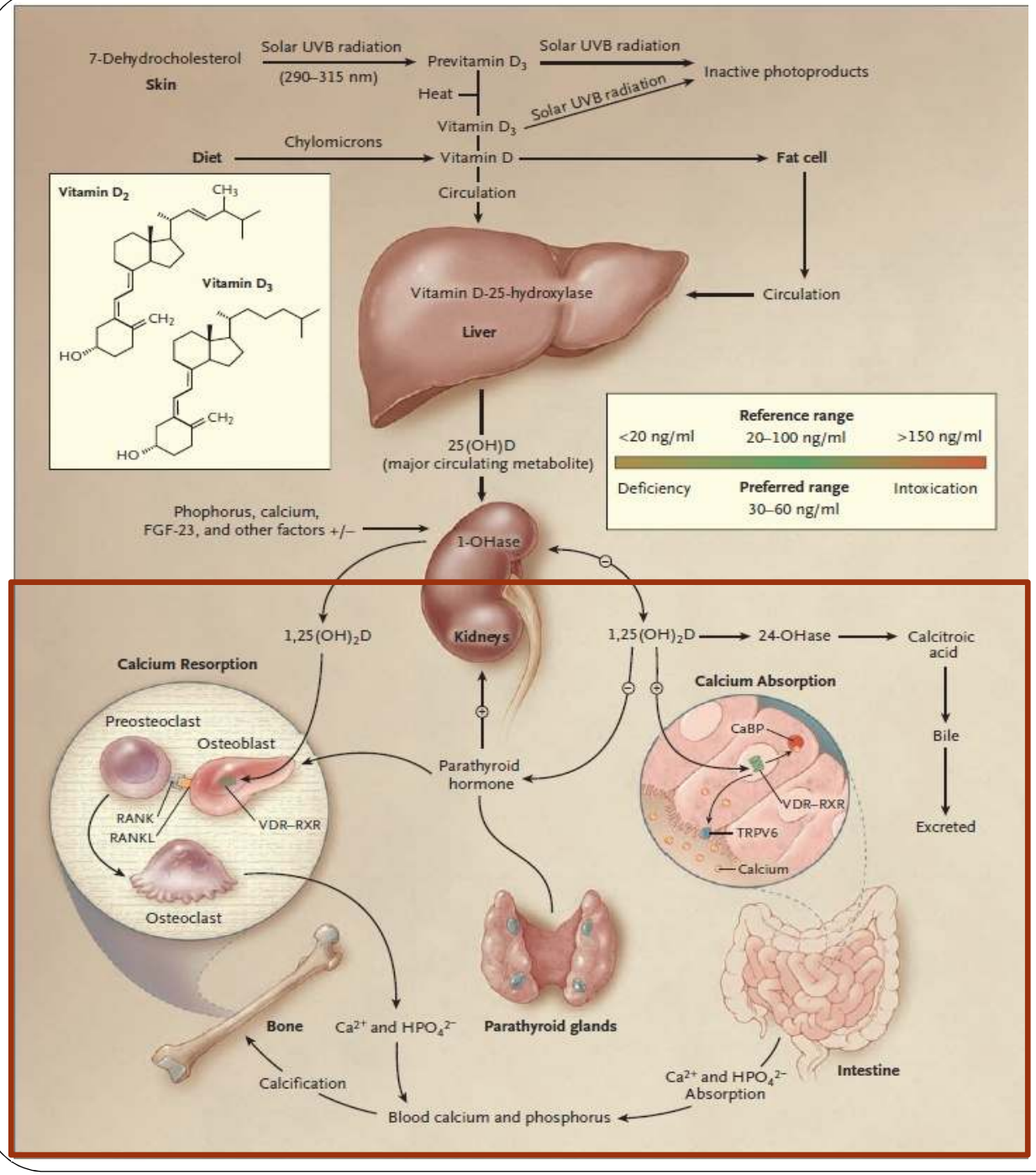
Overview

- Introduction: vitamin D
- Definition of vitamin D status
- Vitamin D status in Korea and other countries
- Determinants of vitamin D status
- Strategies to improve vitamin D status
- Conclusion

Introduction: vitamin D

Vitamin D metabolism

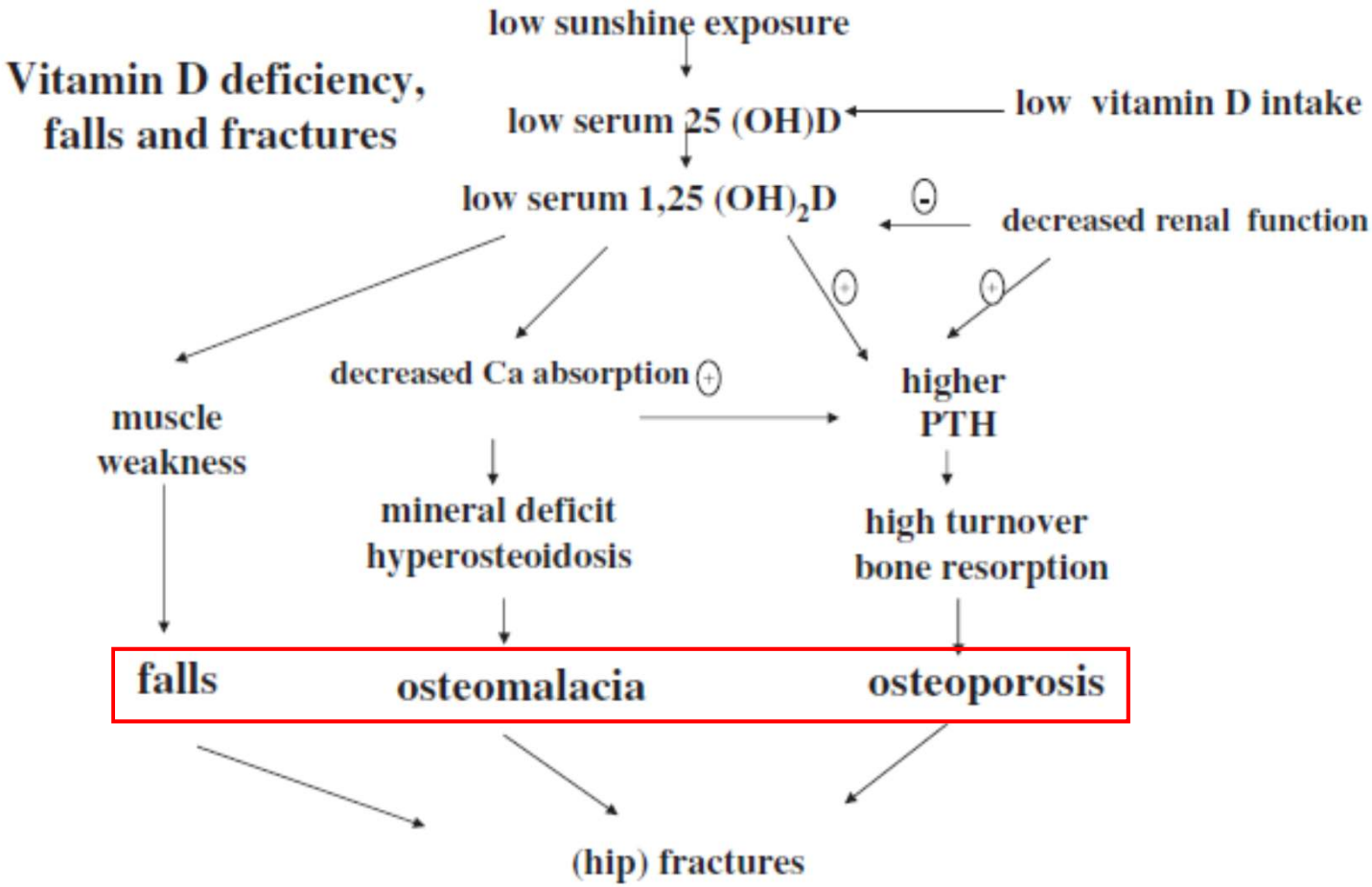




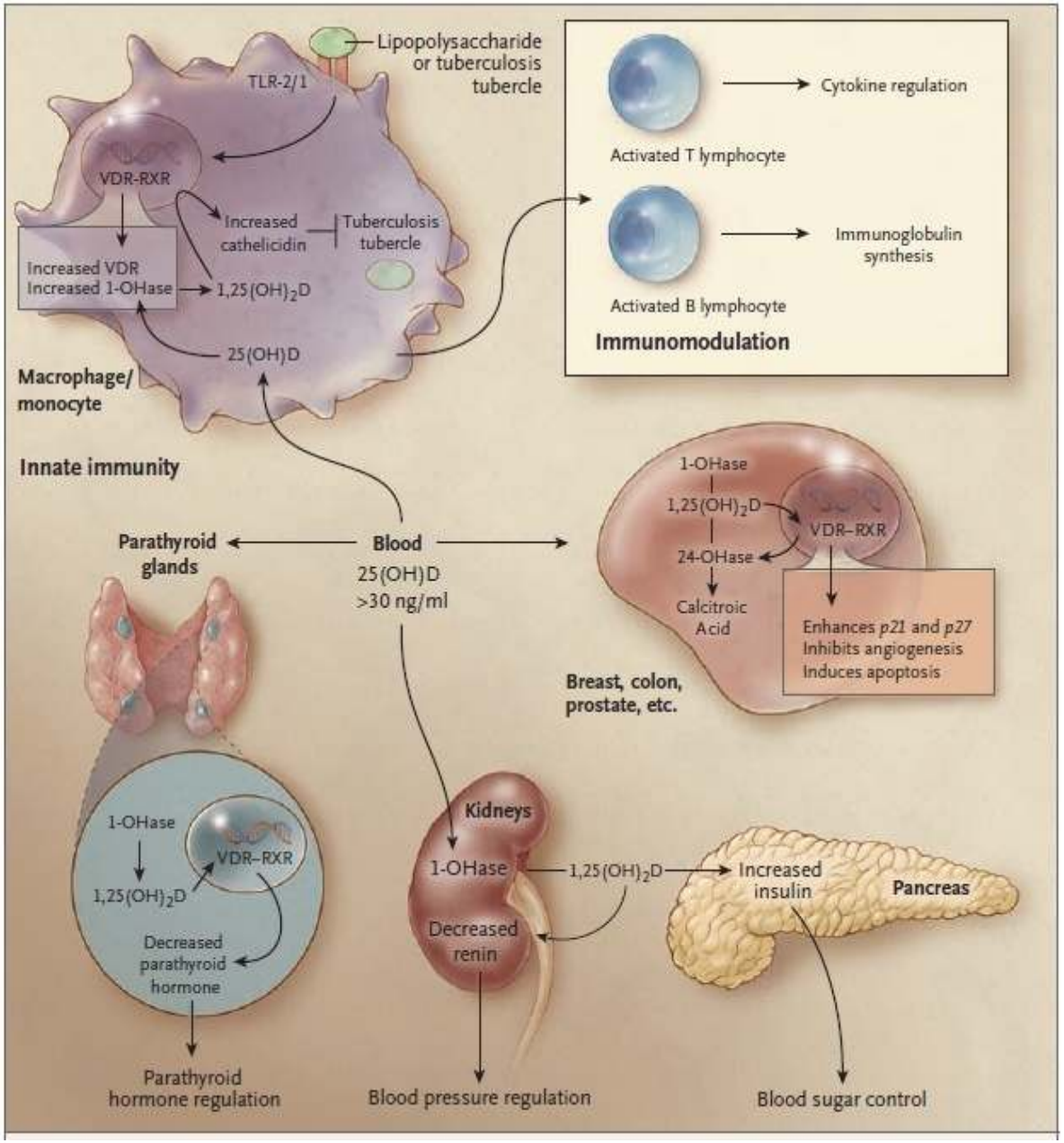
Vitamin D action on bone and mineral metabolism

Holick et al. N Engl J Med 357: 266, 2007

Vitamin D deficiency



Best Practice & Research Clinical Endocrinology & Metabolism 25 (2011) 585–591



Non-skeletal action of vitamin D

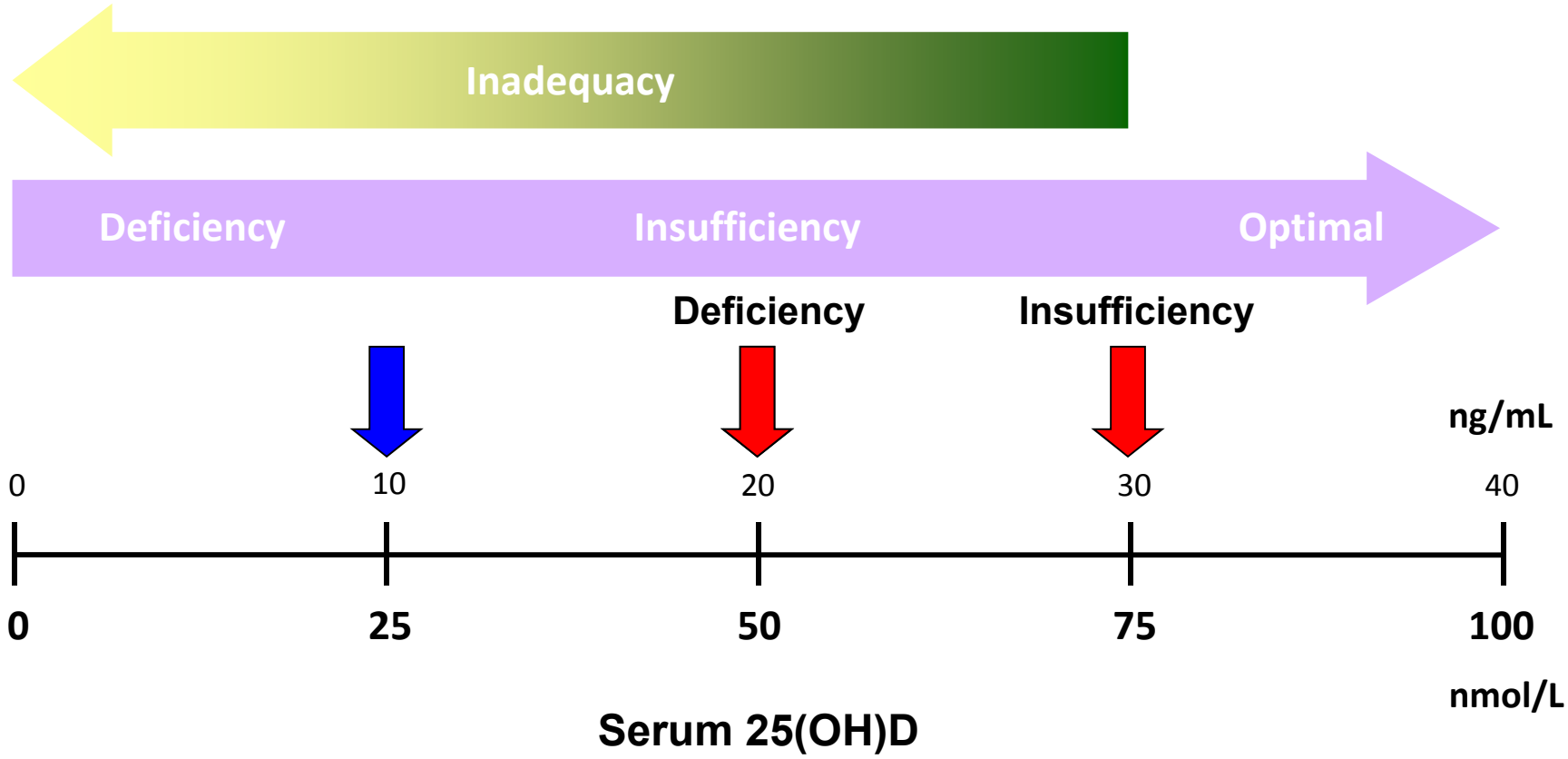
Vitamin D deficiency

- Cardiovascular disease
- Diabetes mellitus
- Cancer
- Autoimmune diseases
- Infection

Holick et al. N Engl J Med 357: 266, 2007

Definition of vitamin D status

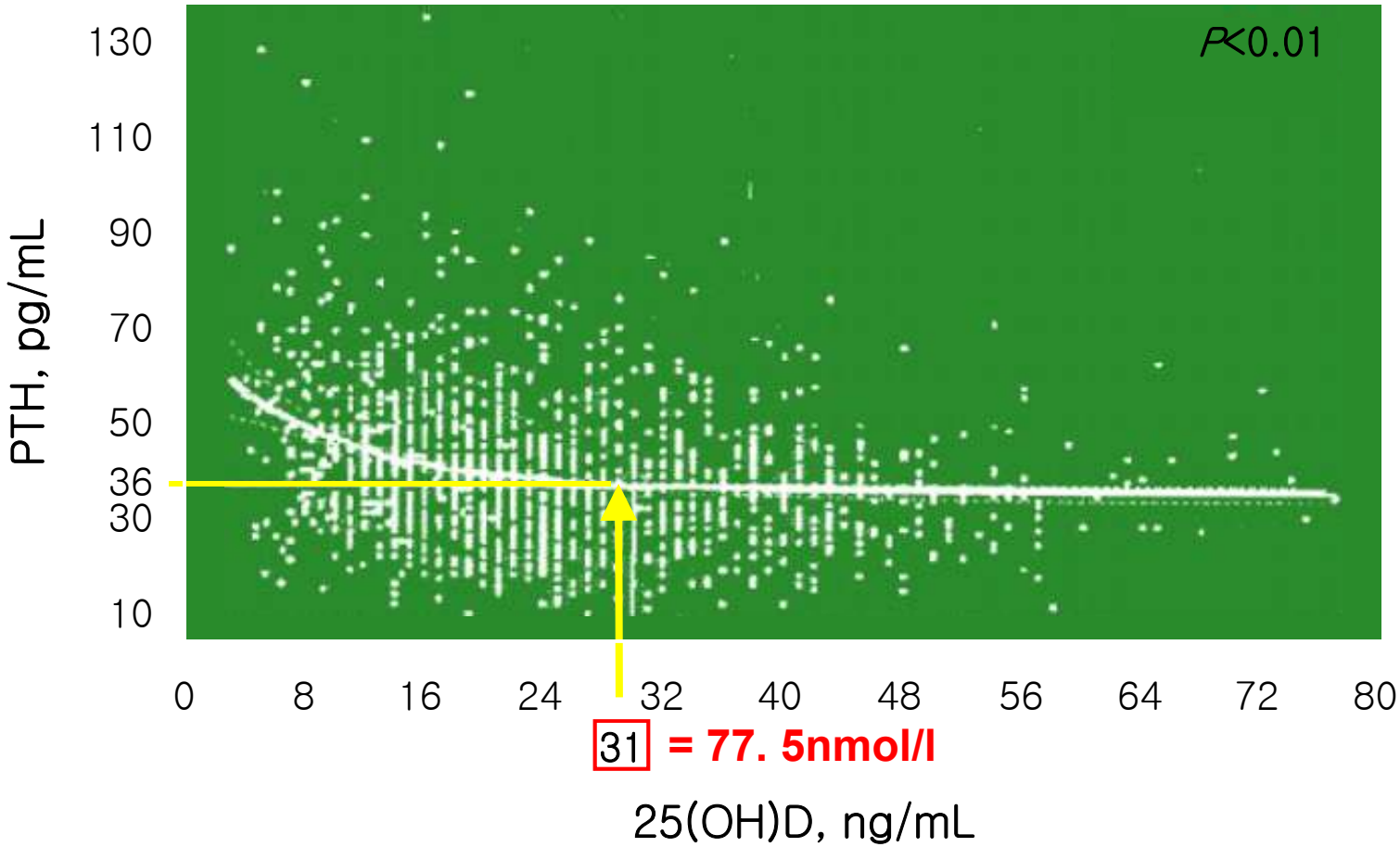
25(OH)D continuum controversy



Guidelines from professional societies

- International workshop on vitamin D (2007)
  - Minimum desirable 25(OH)D is 50 nmol/l
- Osteoporosis Canada (2010)
  - 25(OH) level should be at least 75 nmol/l
- International Osteoporosis Foundation (IOF) (2010)
  - A target level of 25(OH)D of 75 nmol/l
- Institute of Medicine (IOM) (2011)
  - 25(OH)D above the 50 nmol/l is needed for good bone health for practically all individuals

Serum 25(OH)D and PTH

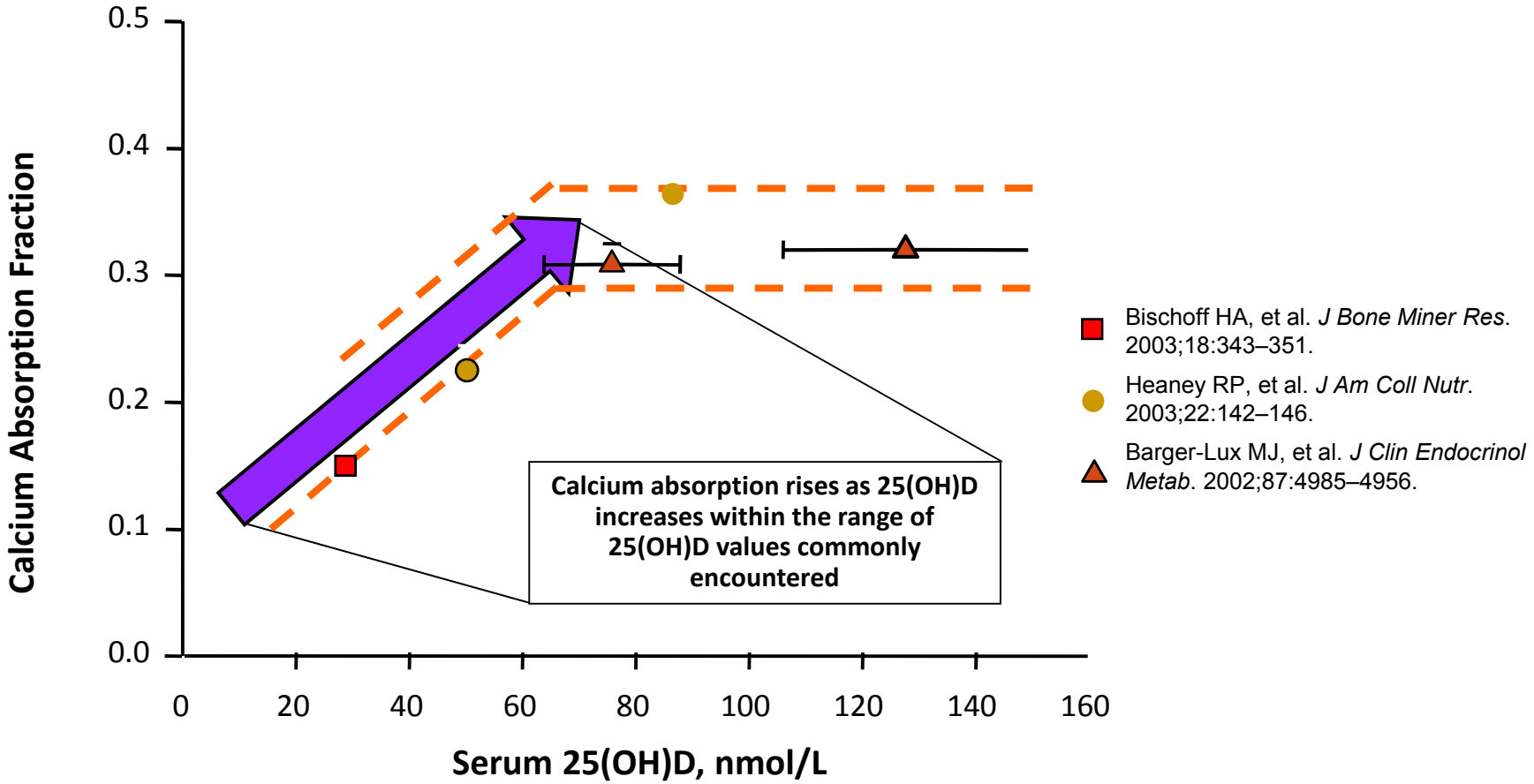


Study design: Multicenter, epidemiologic study of serum 25(OH)D distribution in 1569 healthy men and women in France

Adapted from Chapuy M-C, et al. Osteoporos Int. 1997;7:439-443

Serum 25(OH)D and calcium absorption

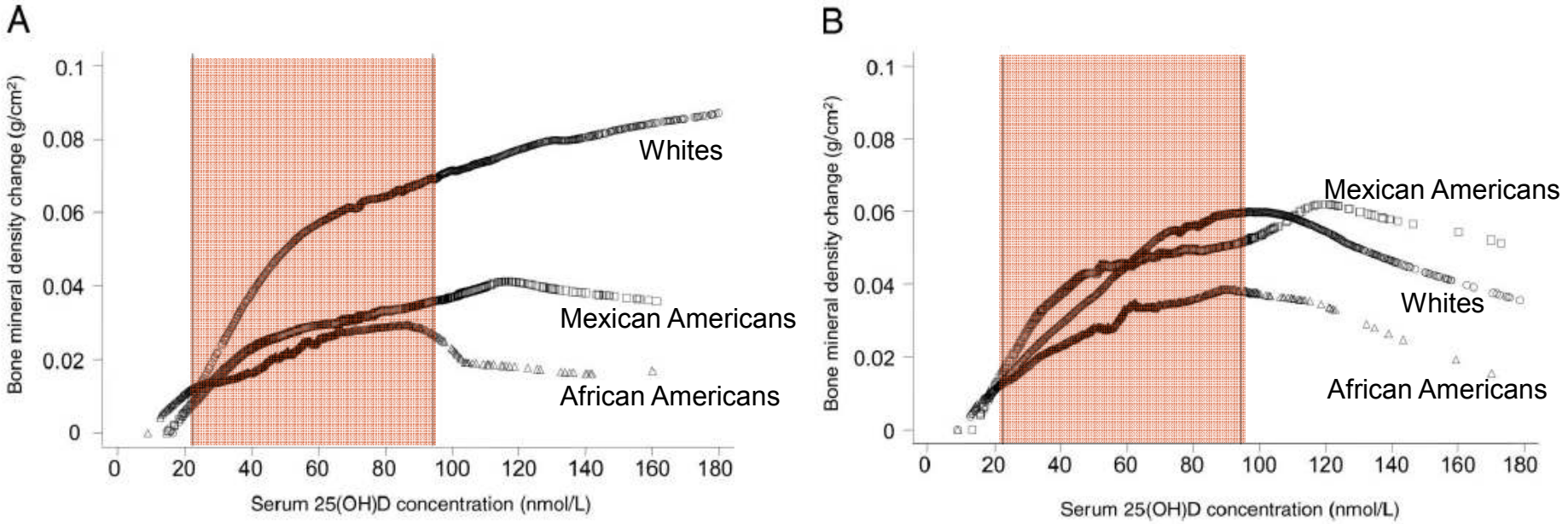
Calcium absorption plateaus at serum 25(OH)D levels ≥ 80 nmol/l



Adapted from Heaney RP. *Am J Clin Nutr*. 2004;80(suppl):1706S–1709S

Serum 25(OH)D and BMD

- The association between serum 25(OH)D and hip BMD among 13,432 subjects
- The third National Health and Nutrition Examination Survey (NHANES III)



Younger (20-49 y)

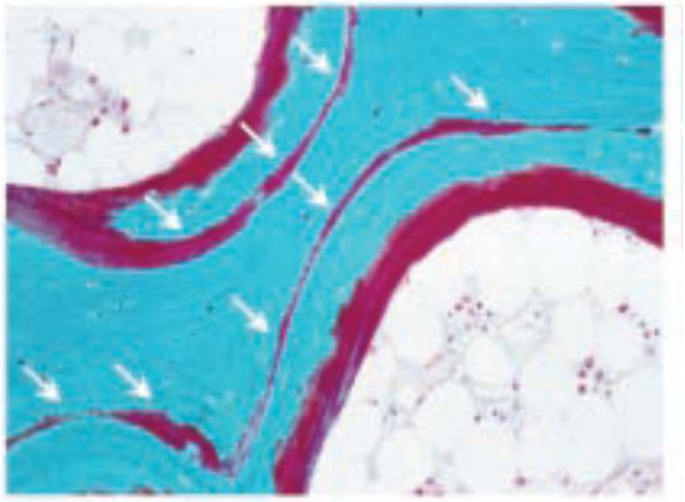
Older (≥50 y)

→ Higher 25(OH)D was associated with higher BMD throughout the reference range of **22.5 to 94 nmol/L**
In younger whites and younger Mexican American, higher 25(OH)D was associated with higher BMD, even that **>100 nmol/L**

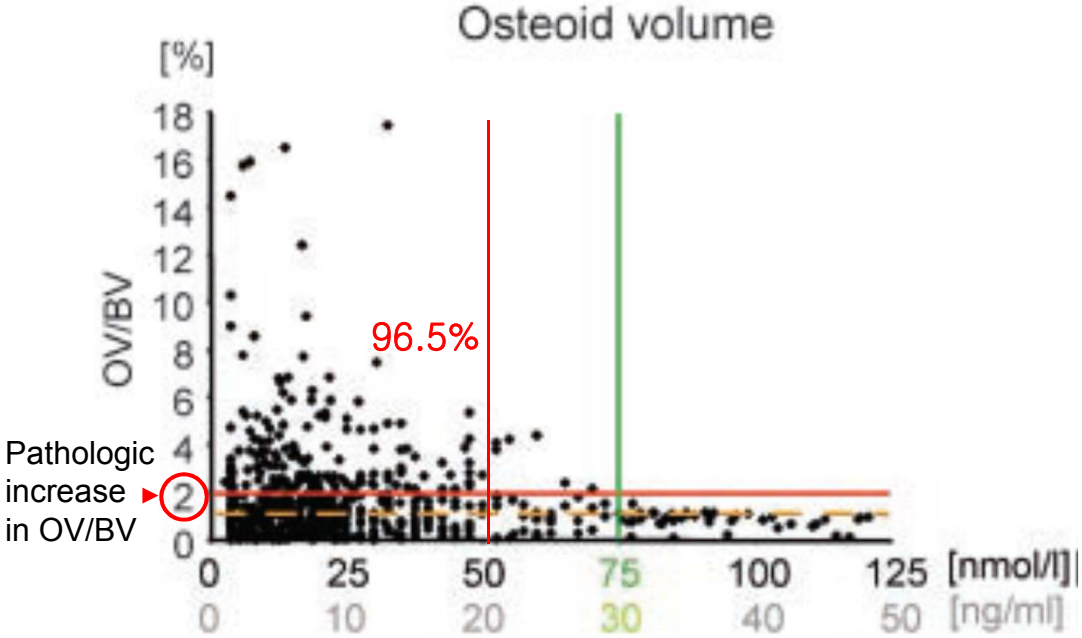
Bischoff-Ferrari et al. Am J Clin Nutr 84: 18-28, 2006

Bone Mineralization Defects and Vitamin D Deficiency

Histomorphometric Analysis of Iliac Crest Bone Biopsies and Circulating 25(OH)D in 675 autopsies



Mineralized bone is stained blue
Unmineralized osteoid is stained red

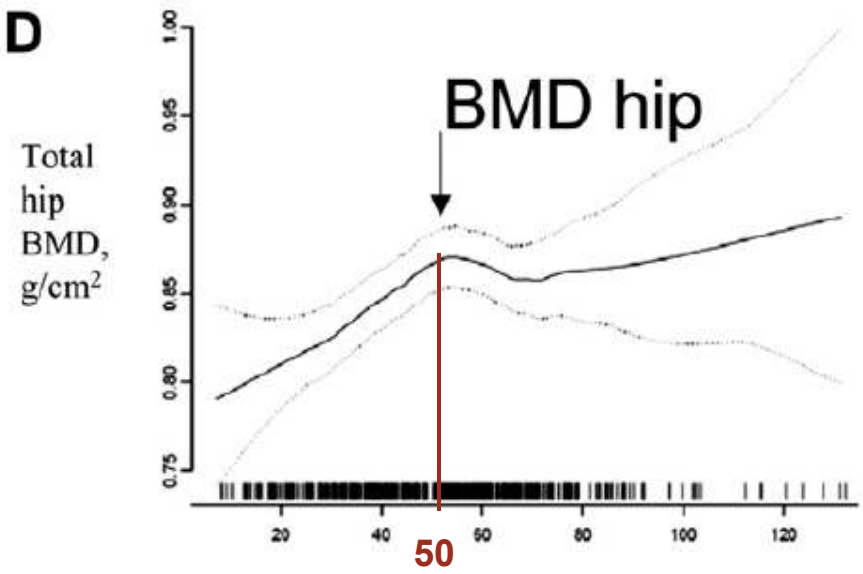


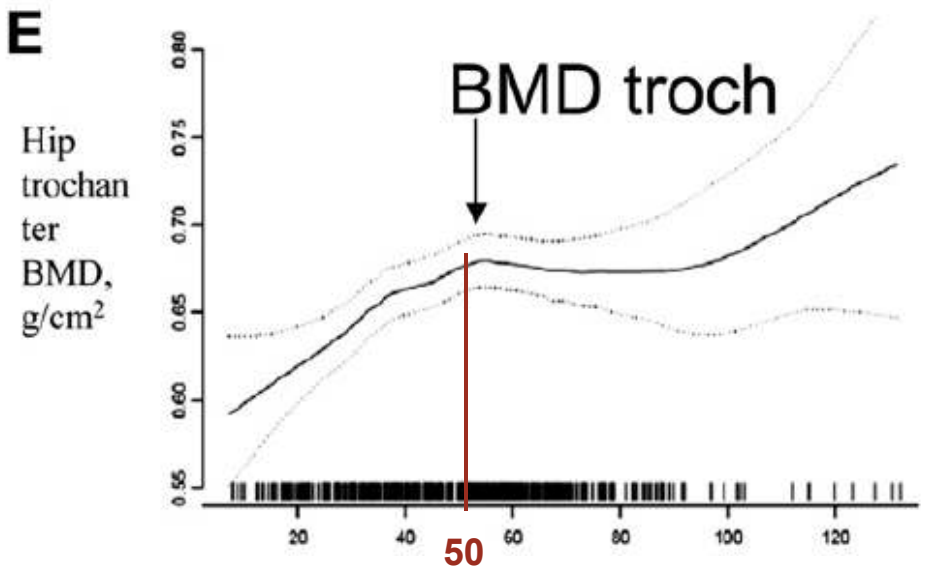
- No case of osteomalacia with 25(OH)D **above 75 nmol/L**
- About 96.5% of osteomalacia cases occurred at a 25(OH)D level of **less than 50 nmol/L**

JBMR 2010;25:305-312

Serum 25(OH)D and BMD

- The Longitudinal Aging Study Amsterdam (LASA)
- A total of 1319 subjects (643 men and 676 women)



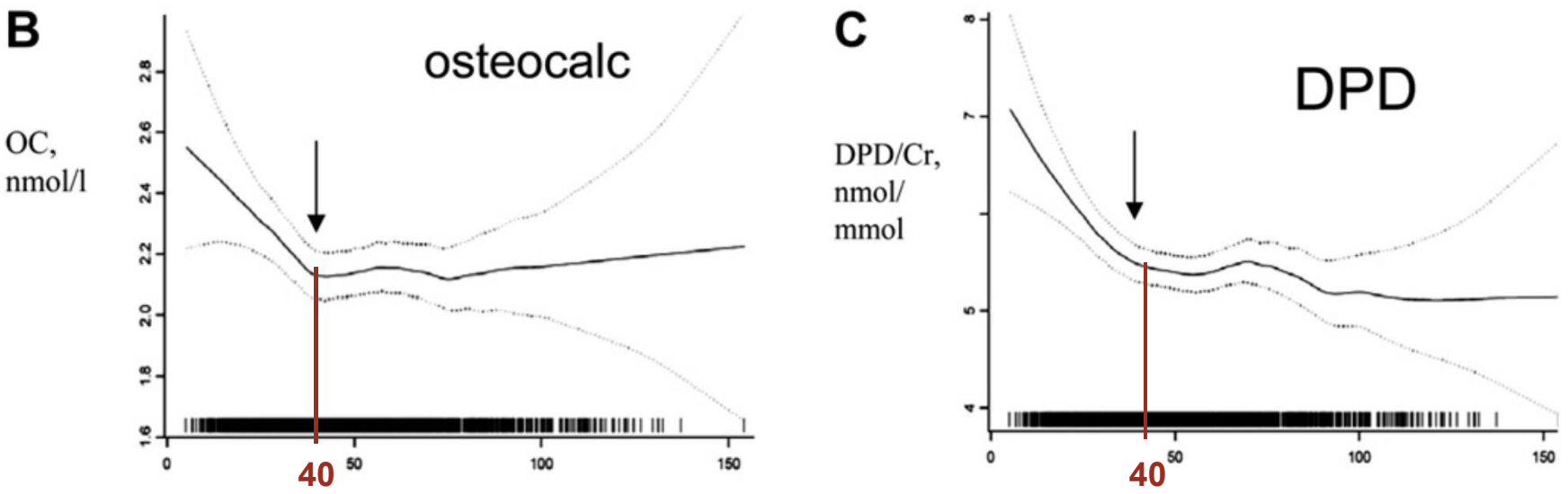


→ A threshold appeared to exist around the serum 25(OH)D level of **50 nmol/L**

J Clin Endocrinol Metab 94: 1244–1250, 2009

Serum 25(OH)D and BTM

- The Longitudinal Aging Study Amsterdam (LASA)
- A total of 1319 subjects (643 men and 676 women)



→ A steep decrease up to the serum 25(OH)D level of **about 40 nmol/L**, followed by a plateau

J Clin Endocrinol Metab 94: 1244–1250, 2009

Serum 25(OH)D and BMD in Korea

The Korea National Health and Nutrition Examination Survey (KNHANES) 2008-2009

	Serum 25(OH)D[a] (nmol/L) in Women				
	<25 (n=119)	**25~50 (n=2526)**	**50~75 (n=1432)**	**>75 (n=300)**	***P* value[b]**
Lumbar spine	0·90±0·00	0·91±0·00	0·92±0·00	0·90±0·01	0·079
Femur trochanter	0·61±0·00***	0·62±0·00*	0·63±0·00	0·62±0·01	<0·001
Femoral neck	0·69±0·00***	0·70±0·00**	0·72±0·00	0·71±0·01	<0·001
Total hip	0·84±0·00***	0·86±0·00**	0·87±0·00	0·86±0·01	<0·001

	Serum 25(OH)D[a] (nmol/L) in Men				
	<25 (n=393)	**25~50 (n=1693)**	**50~75 (n=1560)**	**>75 (n=525)**	***P* value[b]**
Lumbar spine	0·96±0·01	0·96±0·00	0·97±0·00	0·97±0·01	0·063
Femur trochanter	0·67±0·02***	0·68±0·00***	0·70±0·00	0·70±0·00	<0·001
Femoral neck	0·79±0·01***	0·80±0·00***	0·82±0·00	0·81±0·01	<0·001
Total hip	0·95±0·01***	0·96±0·00***	0·98±0·00	0·98±0·01	<0·001

Values are presented as mean ± standard error.
[a] Adjusted by age, BMI, regular walking, regular exercise, current smoking, and season of vitamin D determination
[b] Overall results of covariance analysis.
* *p < 0.05*, ** *p < 0.01*, *** *p < 0.001*, as compared to the reference group (20~30 ng/mL).

Serum 25(OH)D and femur geometry

The Korea National Health and Nutrition Examination Survey (KNHANES) 2008-2009

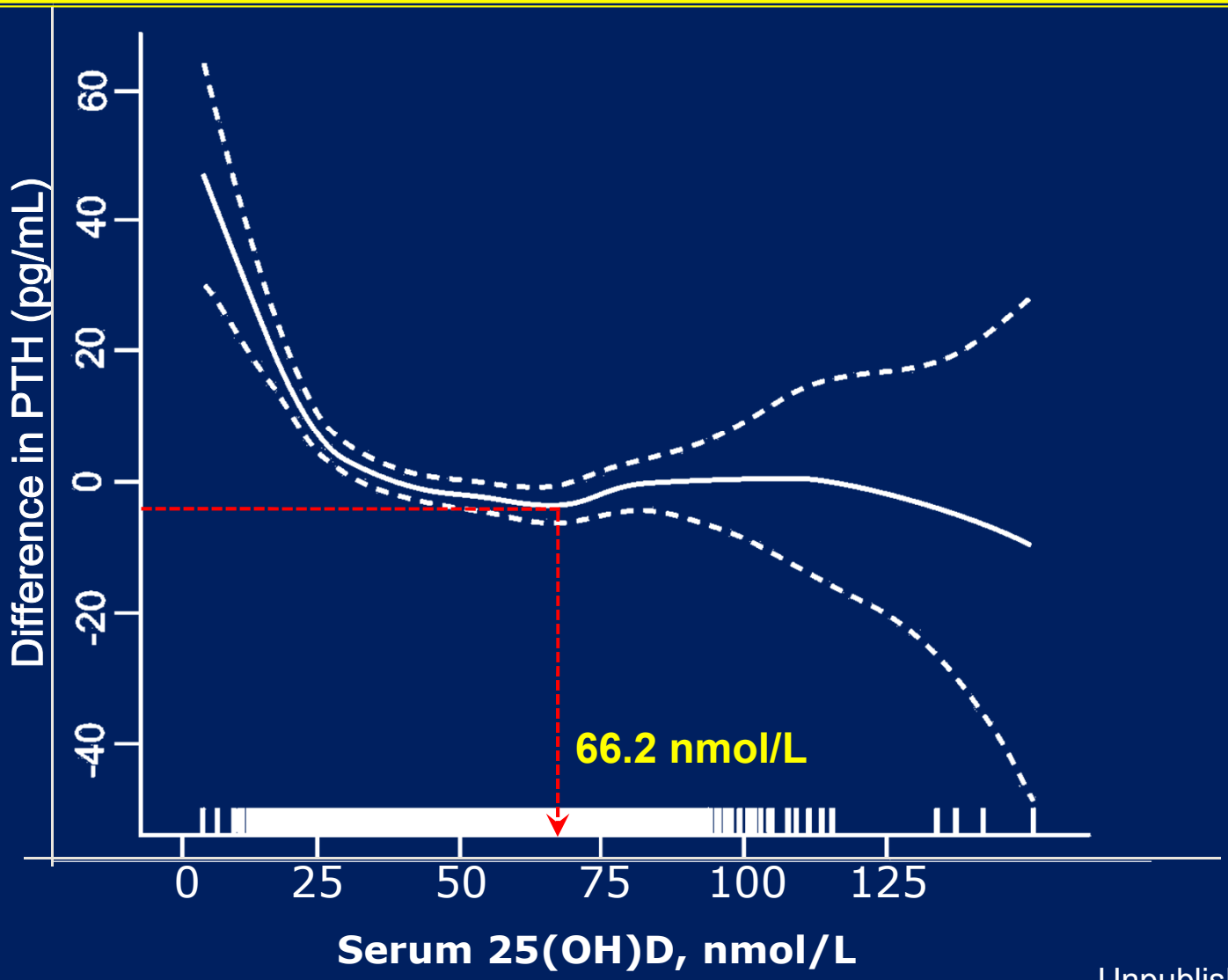
	Serum 25(OH)D[a] (nmol/L) in Women				
	<25 (n=214)	**25~50 (n=1995)**	**50~75 (n=1182)**	**>75 (n=270)**	***P* value[b]**
FN cortical thickness (mm)	1·62±0·00**	1·66±0·00	1·69±0·00	1·67±0·00	0·005
FN CSA(cm2)	2·52±0·03***	2·62±0·01	2·65±0·01	2·62±0·03	<0·001
FN CSMI (cm4)	2·16±0·04***	2·30±0·01	2·34±0·02	2·32±0·04	<0·001
FN buckling ratio	11·8 ±0·19**	11·34±0·06	11·20±0·08	11·19±0·18	0·013

	Serum 25(OH)D[a] (nmol/L) in Men				
	<25 (n=50)	**25~50 (n=995)**	**50~75 (n=1088)**	**>75 (n=361)**	***P* value[b]**
FN cortical thickness (mm)	1·76±0·00	1·83±0·00	1·86±0·00	1·86±0·00	0·020
FN CSA(cm2)	3·18±0·06	3·27±0·01*	3·34±0·01	3·35±0·02	0·002
FN CSMI (cm4)	3·68±0·11	3·76±0·02**	3·87±0·02	3·93±0·04	<0·001
FN buckling ratio	12·10±0·29	11·56±0·07	11·33±0·06	11·38±0·10	0·020

FN, femur neck; CSA, cross-sectional area; CSMI, cross-sectional moment of inertia

Unpublished data

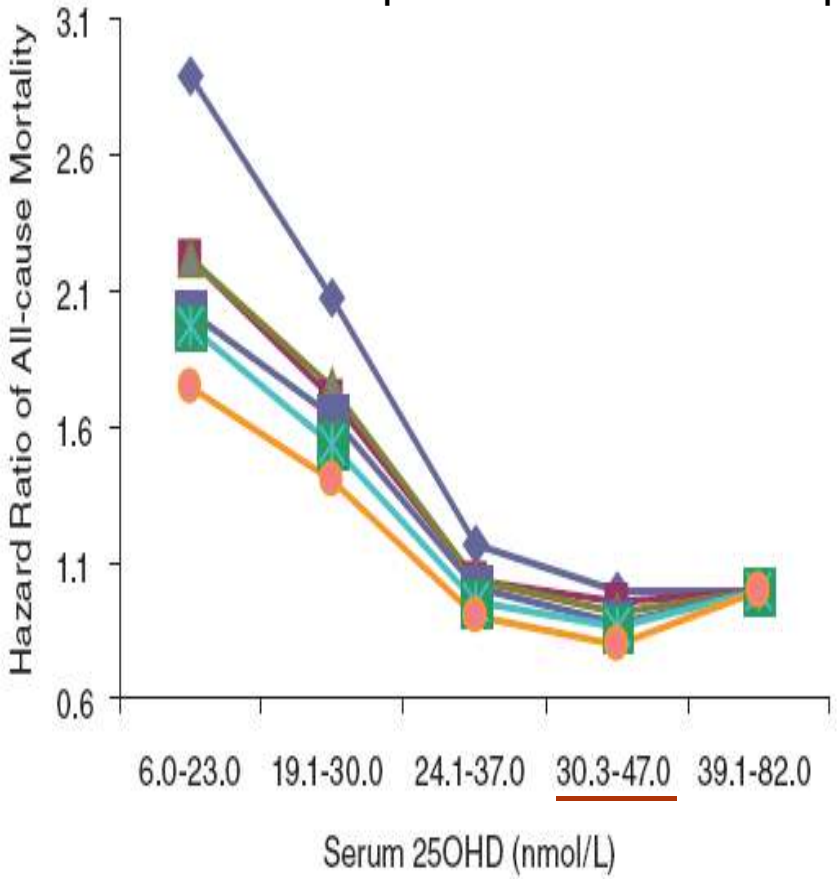
Association between serum 25(OH)D and PTH

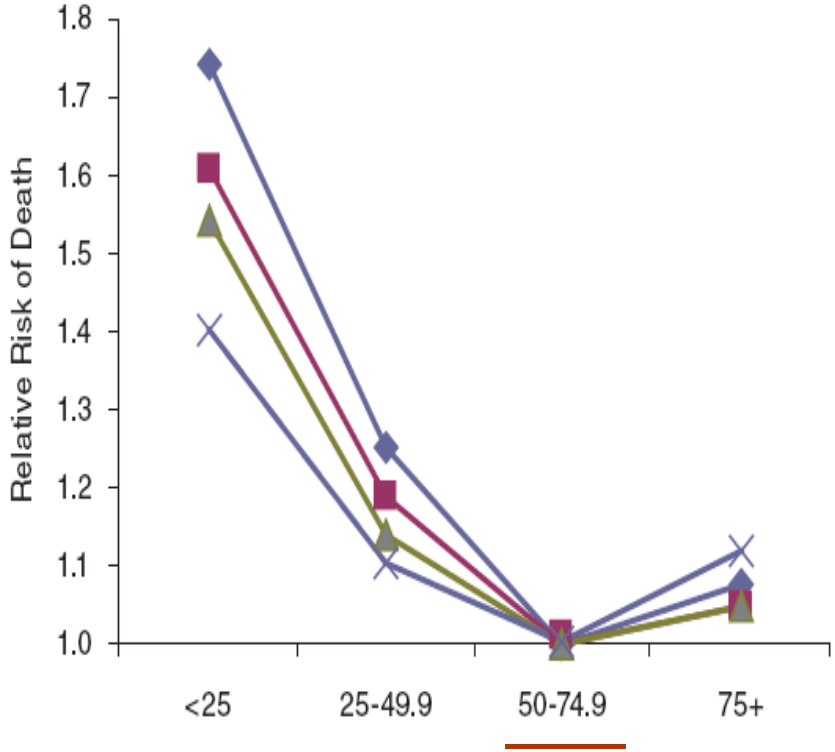


Unpublished data

Serum 25(OH)D level and all-cause mortality

- Cohort studies
- U-shaped or reverse J-shaped pattern



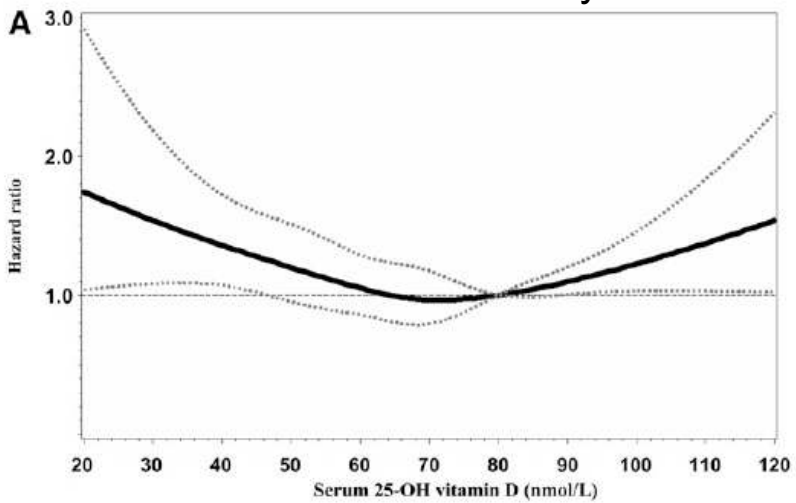


Visser et al., 2006; Jia et al., 2007

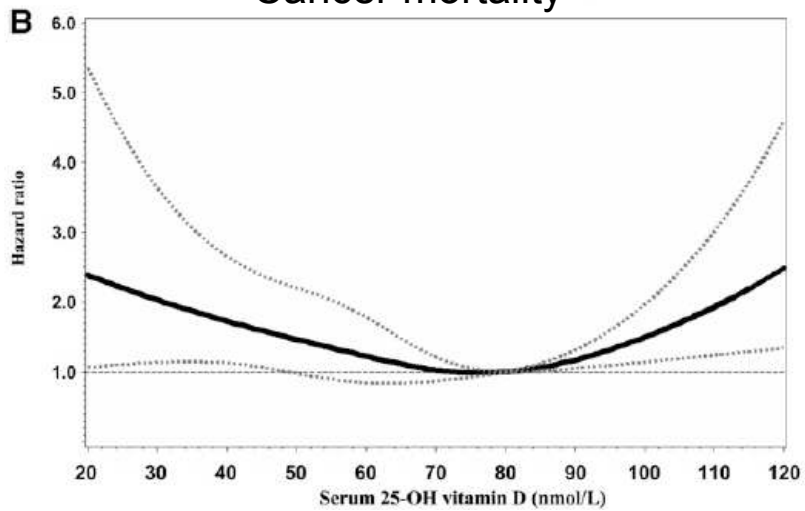
Serum 25(OH)D level and all-cause mortality

- The Uppsala Longitudinal Study of Adult Men
- A community-based cohort of elderly men (mean age: 71 yr, n= 1,194)
- Follow up: 12.7 yr
- U-shaped or reverse J-shaped pattern

All-cause mortality



Cancer mortality

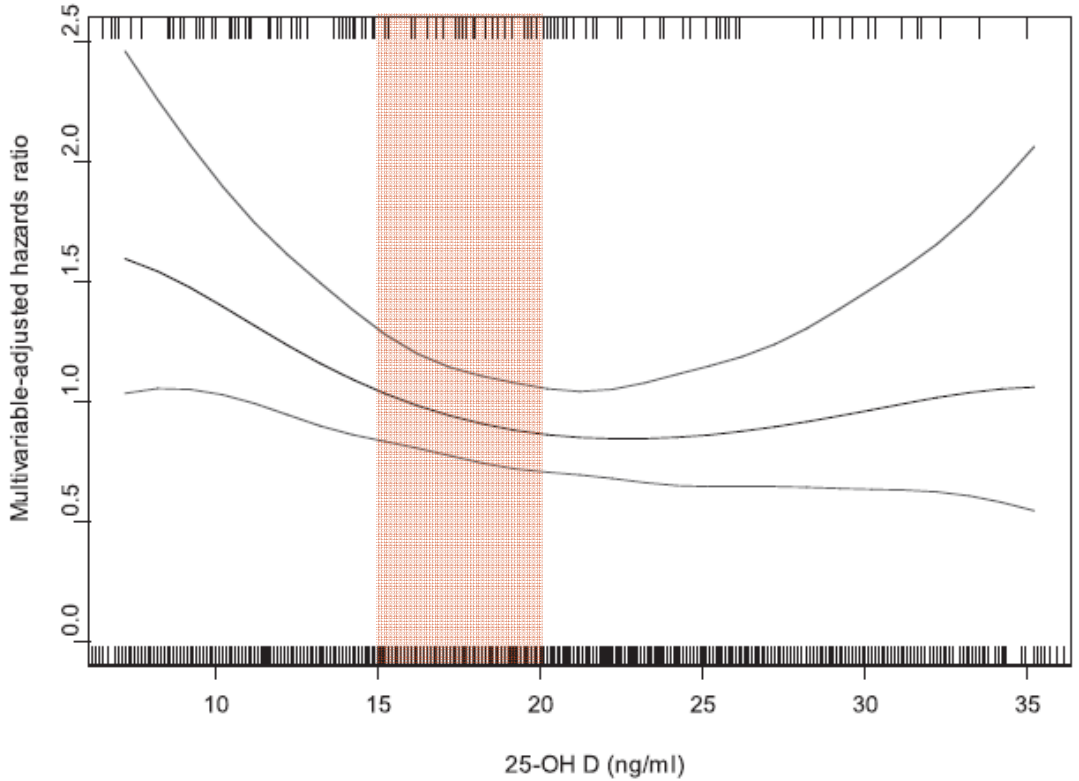


→ An approximately 50% higher total mortality rate was observed among men in the lowest 10% **(<46 nmol/L)** and the highest 5% **(>98 nmol/L)** of plasma 25(OH)D concentrations compared with intermediate concentrations.

Am J Clin Nutr 2010;92:841–8

Relation between baseline vitamin D status and incident cardiovascular events

- The Framingham Offspring cohort
- 1739 participants (mean age 59 years) without prior cardiovascular disease



→ A nonlinear relation between 25(OH)D levels and cardiovascular risk, with increased risk for cardiovascular events at 25(OH)D levels below 37.5 to 50 nmol/L

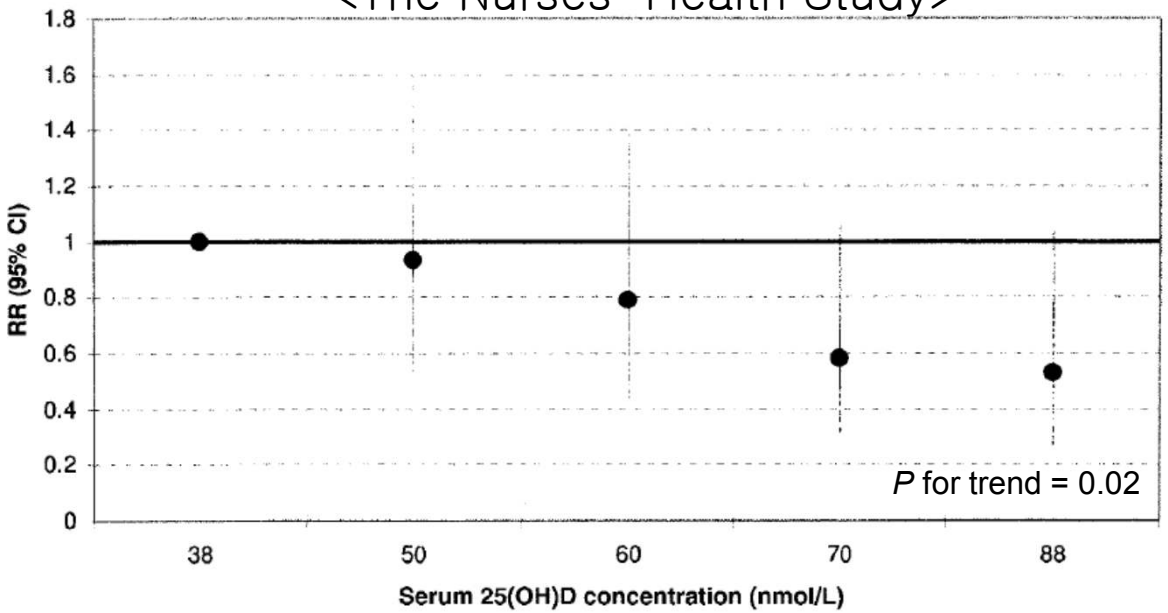
Wang et al. Circulation. 2008;117:503-51

Vitamin D and colorectal cancer

- Previous studies found a inverse associations of vitamin D intake with colon or rectal cancer

- A lower risk of colorectal cancer associated with higher 25(OH)D levels was reported

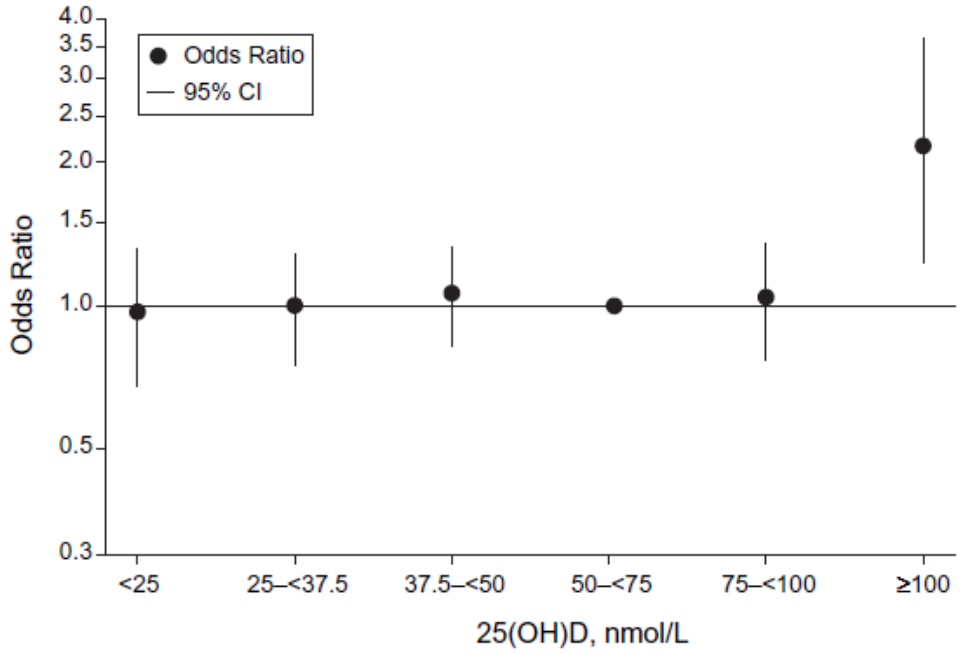
<The Nurses' Health Study>



Bischoff-Ferrari et al. Am J Clin Nutr 2006;84:18 –28

Vitamin D and pancreatic cancer

- The Cohort Consortium Vitamin D Pooling Project of Rarer Cancers
- Involving 10 cohorts that are members of the National Cancer Institute Cohort Consortium



→ An increased risk at very high levels (above 100 nmol/L) was noted

Am J Epidemiol 2010;172:4–9

Vitamin D and prostate cancer

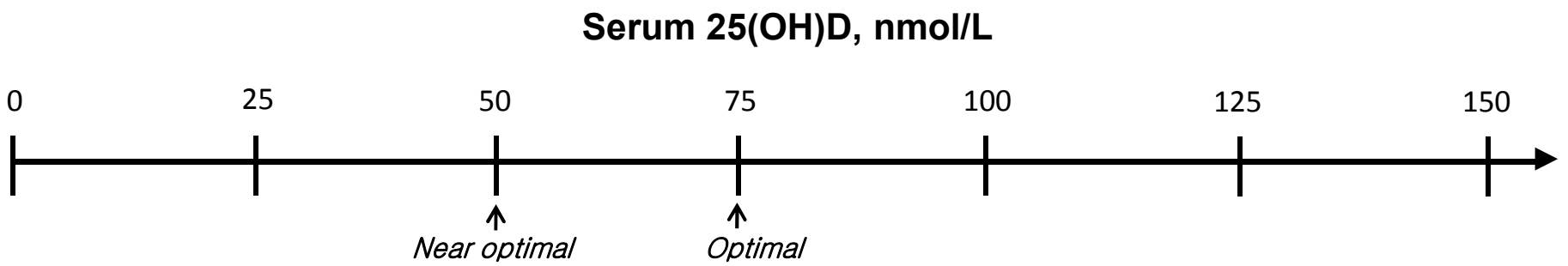
- A longitudinal nested case-control study in the Nordic countries

Vitamin D level (nmol/l)	All countries		Norway		Finland		Sweden	
	Number of cases	OR (CI)	Number of cases	OR (CI)	Number of cases	OR (CI)	Number of cases	OR (CI)
≤ 19	19	1.5 (0.8–2.7)	5	0.9 (0.3–2.8)	13	2.4 (1.1–5.1)	1	1.3 (0.1–12.5)
20–39	169	1.3 (0.98–1.6)	89	1.2 (0.9–1.7)	68	1.9 (1.1–3.1)	12	0.7 (0.3–1.4)
40–59 (ref.)	229	1	155	1	29	1	45	1
60–79	138	1.2 (0.9–1.5)	98	1.2 (0.8–1.7)	18	1.4 (0.7–2.8)	22	1.0 (0.5–1.8)
≥80	67	1.7 (1.1–2.4)	57	1.8 (1.1–2.8)	4	1.2 (0.4–3.8)	6	1.5 (0.5–4.4)

→ Both high and low levels of blood vitamin D are associated with a higher prostate cancer risk

Int J Cancer 108, 104–108 (2004)

Definition of vitamin D status



Insufficient for skeletal health

Generally appropriate and safe

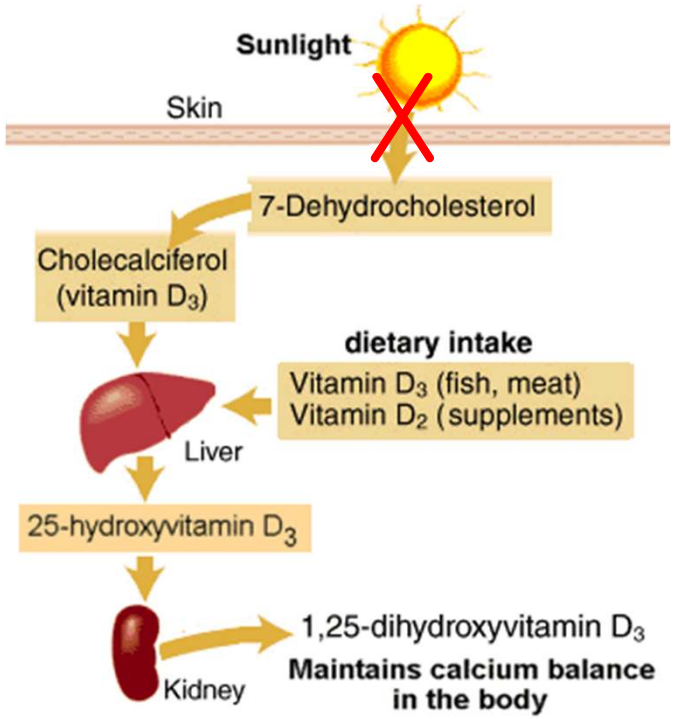
- 25(OH)D < 50 nmol/L: insufficient for skeletal health
- 25(OH)D ≥ 50 nmol/L: generally appropriate and safe for public health
- 25(OH)D ≥ 75 nmol/L: needed for vulnerable people (osteoporotic, elderly)
- 25(OH)D ≥ 375 nmol/L: intoxication can occur
- 25(OH)D between 100~150 and 375 nmol/L: consider potential risk and benefit. Further research is needed

Potential benefit
Further benefit in skeletal health
Potential benefit in extra-skeletal health

vs

Potential risk
Cardiovascular events, Cancer risk
All-cause mortality

Vitamin D status in Korea and other countries


Sunlight
Skin
7-Dehydrocholesterol
Cholecalciferol
(vitamin D_3)
dietary intake
Vitamin D_3 (fish, meat)
Vitamin D_2 (supplements)
Liver
25-hydroxyvitamin D_3
1,25-dihydroxyvitamin D_3
Kidney
Maintains calcium balance
in the body

Demographic Differences and Trends of Vitamin D Insufficiency in the US Population, 1988-2004

Adit A. Ginde, MD, MPH; Mark C. Liu, MD; Carlos A. Camargo Jr, MD, DrPH

Table 1. Description of Demographics and Serum 25(OH)D Levels in NHANES III and NHANES 2001-2004

	NHANES III (1988-1994)[a]			NHANES 2001-2004[a]		
	No. of Participants	Estimated US Population, Millions	% of Participants (95% CI)[b]	No. of Participants	Estimated US Population, Millions	% of Participants (95% CI)[b]
Total	18 883	195	100	13 369	221	100
Age, y						
12-19	2937	26	13 (13-14)	4224	29	13 (12-14)
20-39	6455	77	40 (38-42)	3249	75	34 (32-36)
40-59	4293	54	28 (27-29)	2726	74	34 (32-35)
≥60	5198	37	19 (17-21)	3170	41	19 (18-20)
Sex						
Male	8840	94	48 (48-49)	6512	107	49 (48-49)
Female	10 043	101	52 (51-52)	6856	114	51 (51-52)
Race/ethnicity						
NH white	7428	146	75 (72-78)	6131	158	72 (67-76)
NH black	5362	22	11 (10-13)	3149	25	11 (9-14)
Mexican American	5305	11	6 (5-7)	3211	18	8 (6-11)
Other	788	16	8 (7-10)	878	20	9 (7-12)
25(OH)D level, ng/mL						
<10	684	4	2 (2-2)	1321	14	6 (5-8)
10 to <30	12 302	104	53 (51-55)	9843	157	71 (68-73)
≥30	5897	87	45 (43-47)	2205	50	23 (20-26)

Ginde et al. Arch Intern Med 169:626, 2009

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Adit A. Ginde, MD, MPH; Mark C. Liu, MD; Carlos A. Camargo Jr, MD, DrPH

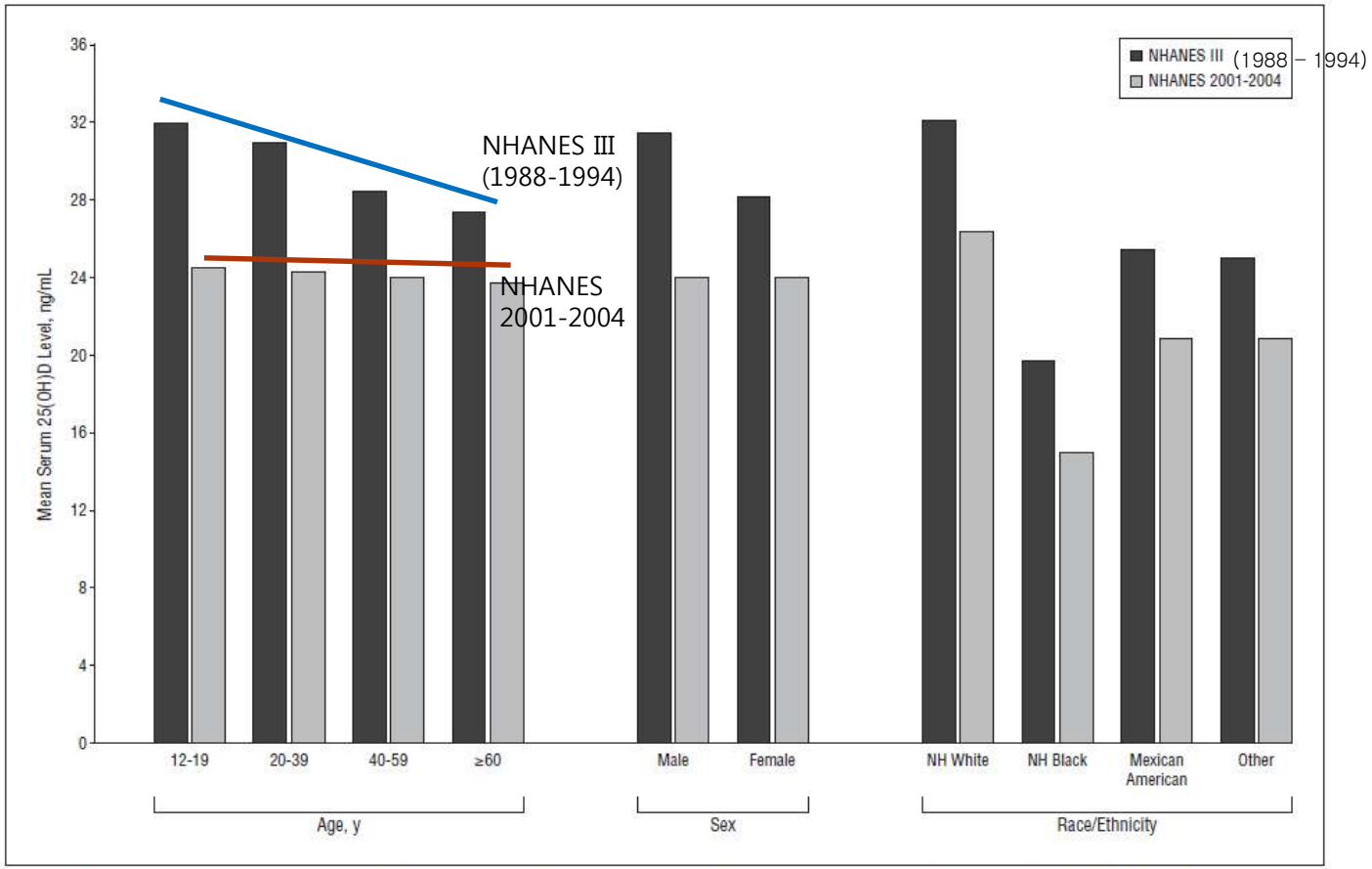
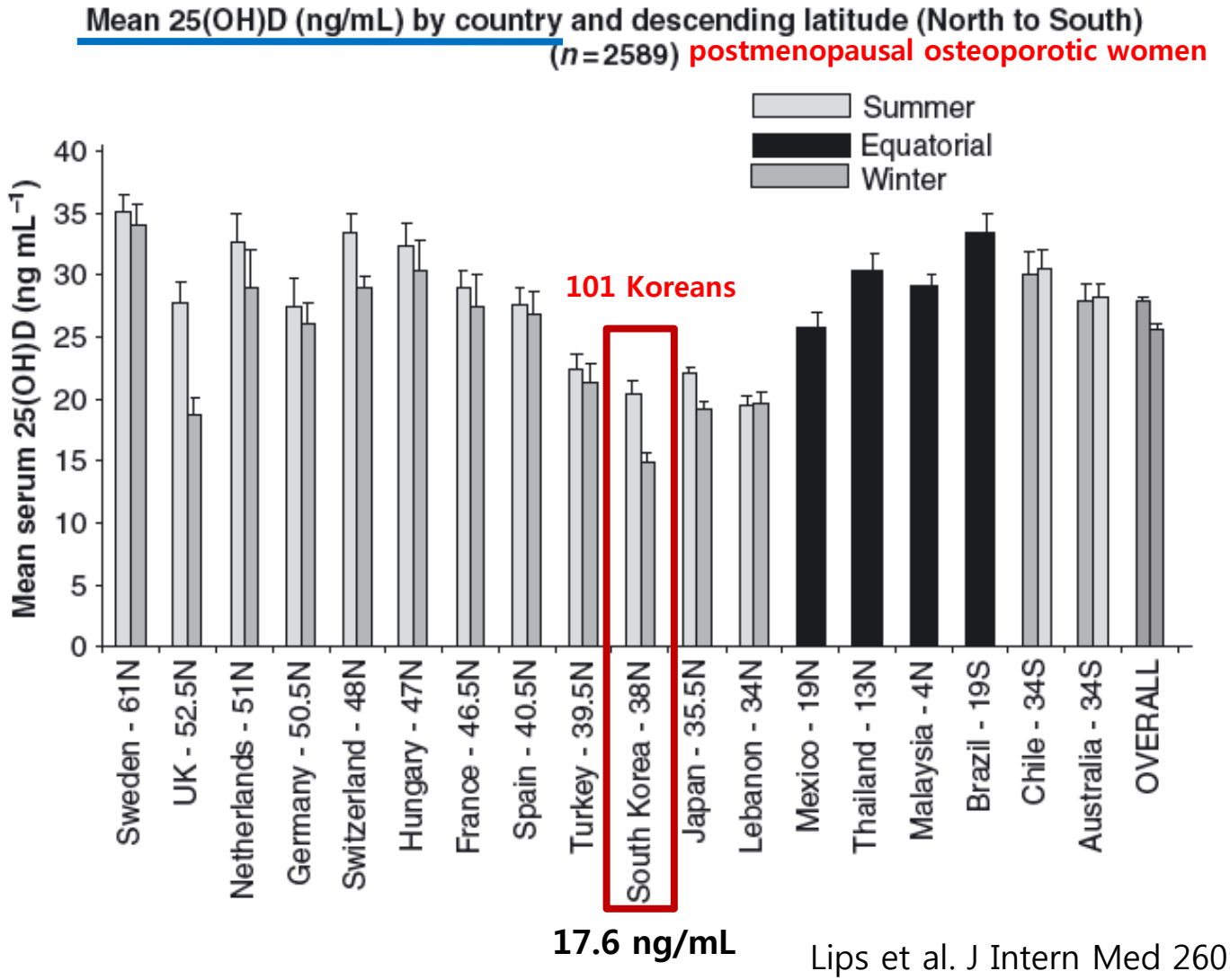


Figure 1. Mean serum 25-hydroxyvitamin D (25[OH]D) levels in the Third National Health and Nutrition Examination Survey (NHANES III) (1988-1994) and in NHANES 2001-2004, stratified by demographic characteristics. NH indicates non-Hispanic. To convert 25(OH)D levels to nanomoles per liter, multiply by 2.496.

Ginde et al. Arch Intern Med 169:626, 2009

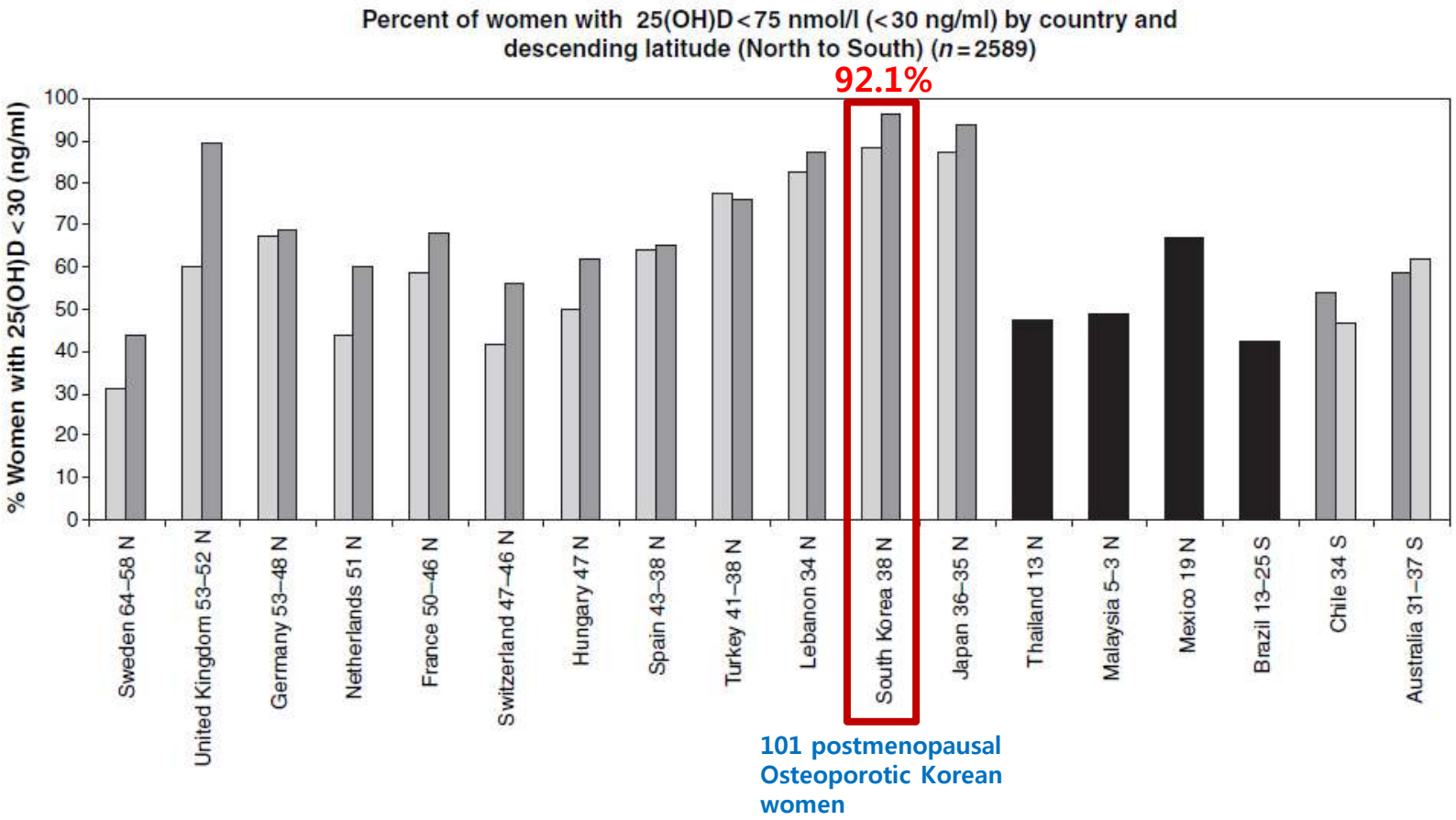
Vitamin D status in Korea



Lips et al. J Intern Med 260: 245, 2006

Vitamin D status in Korea

25(OH)D < 75nmol/l

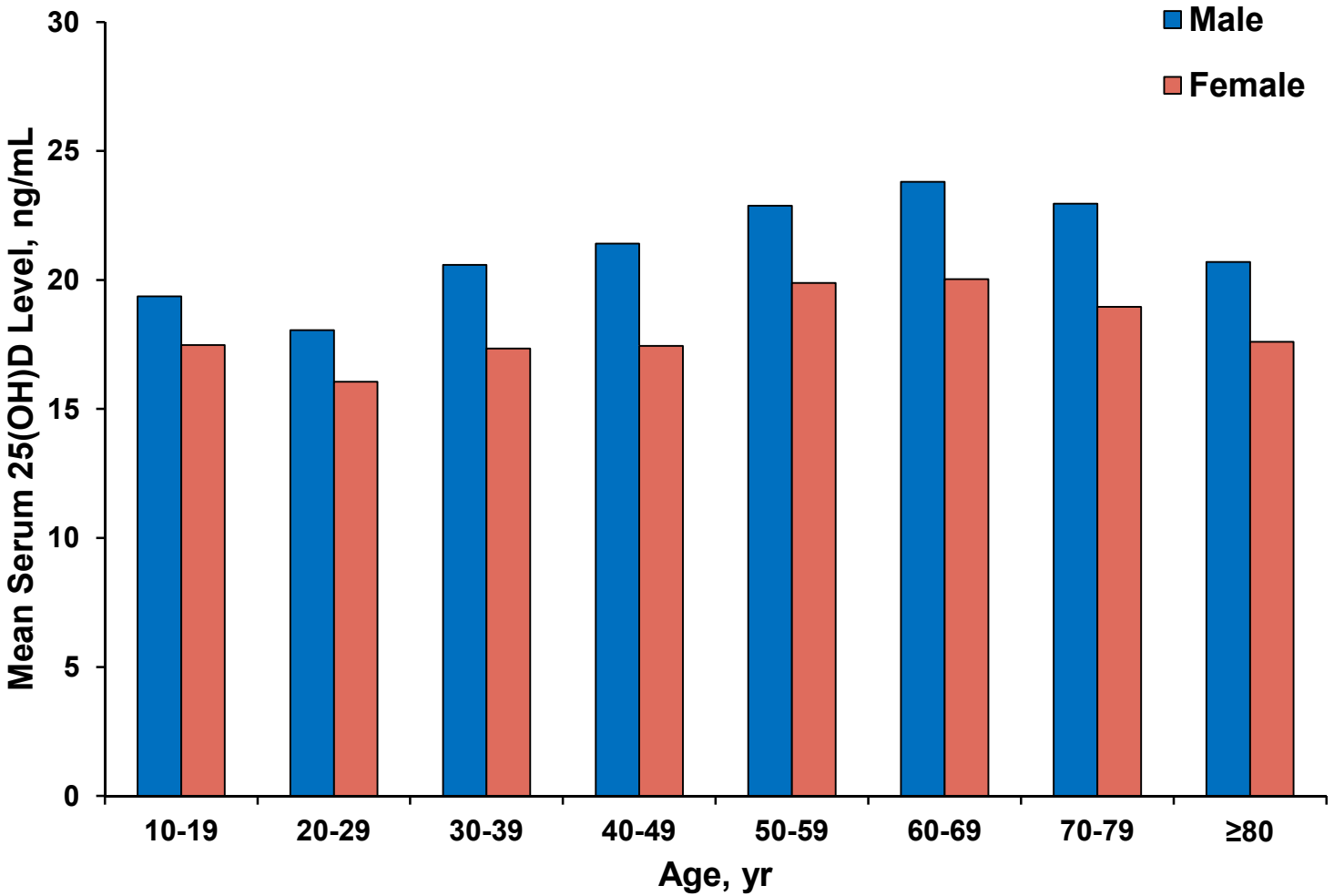


Rizzoli et al. Int J Clin Pract 60: 1013, 2006

The Fourth Korean National Health and Nutrition Examination Survey

- The KNHANES has been conducted periodically since 1998 to assess the health and nutritional status of the **civilian, non- institutionalized population** of the Korea
- A **cross-sectional** and **nationally representative survey** conducted by the Division of Chronic Disease Surveillance, Korea Centers for Disease Control and Prevention
- **Duration:** Feburary, 2008 – Decemter, 2008
- **Participants:** Total 6,925 (Male- 3,047, Female- 3,878)
- **Age:** ≥10 yr
- **25-hydroxyvitamin D assay:** RIA (DiaSorin)

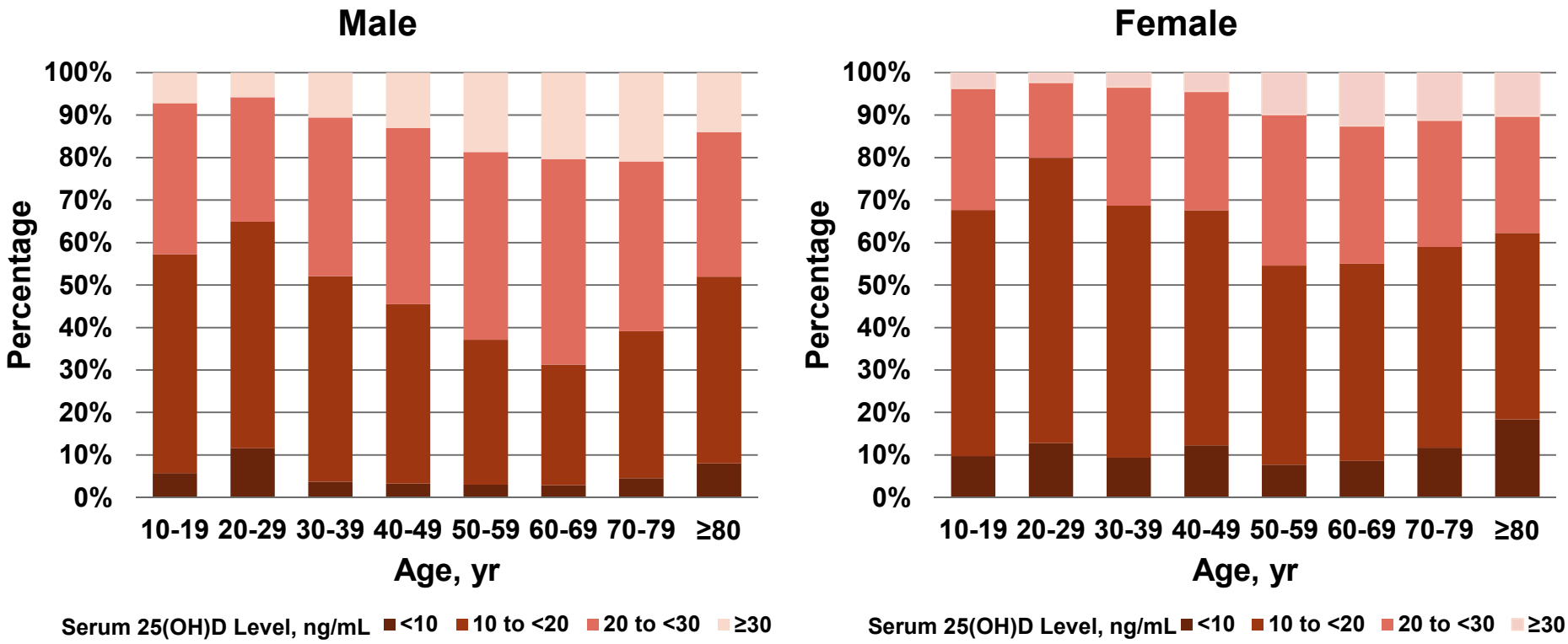
Age-related change of serum 25(OH)D levels



→ Mean serum 25(OH)D level: **53 nmol/L** (21.2 ng/dL) for men, and **45.5 nmol/L** (18.2 ng/dL) for women

Prevalence of vitamin D insufficiency by 10-year age categories

The Korea National Health and Nutrition Examination Survey (KNHANES) 2008

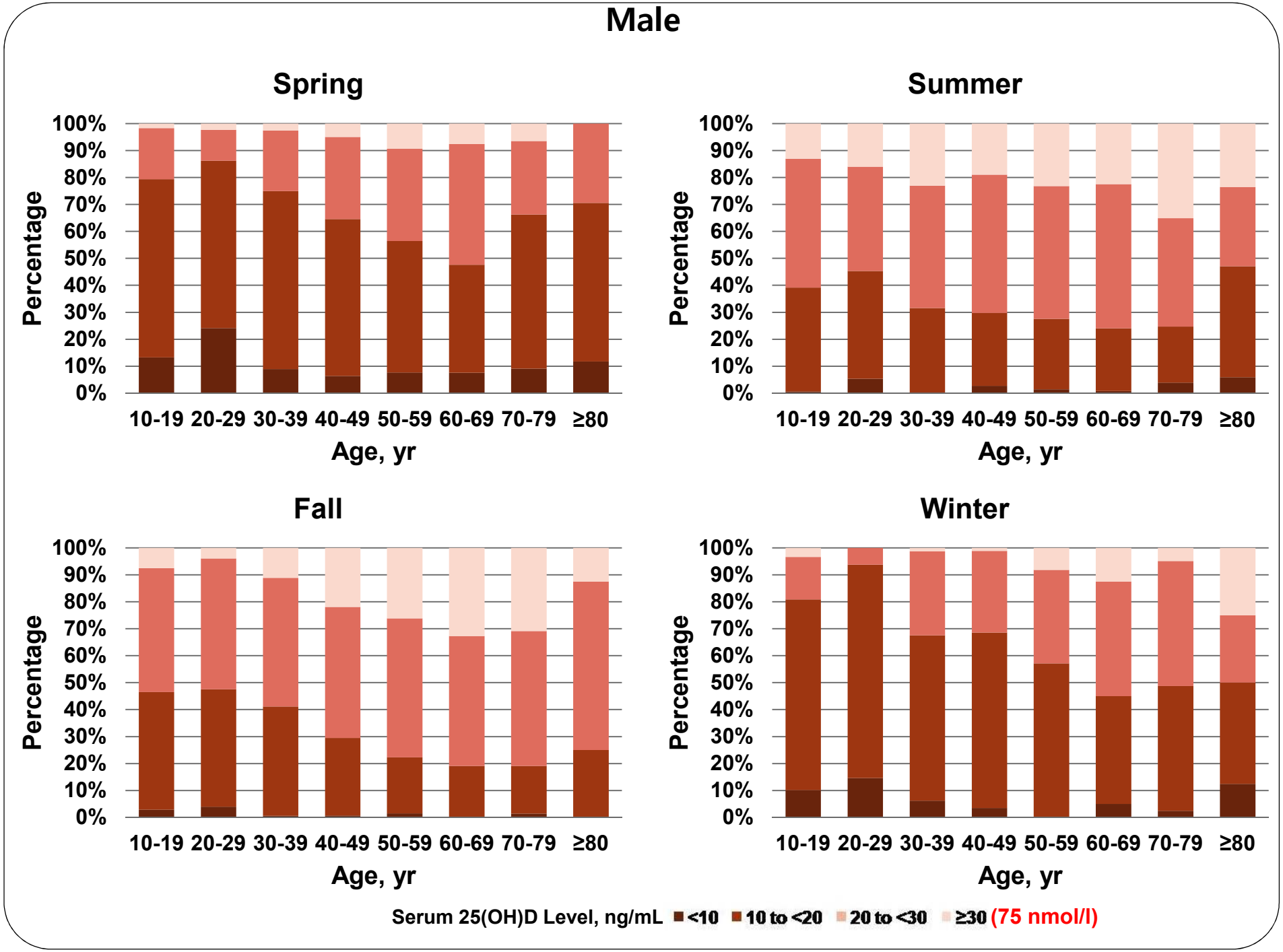


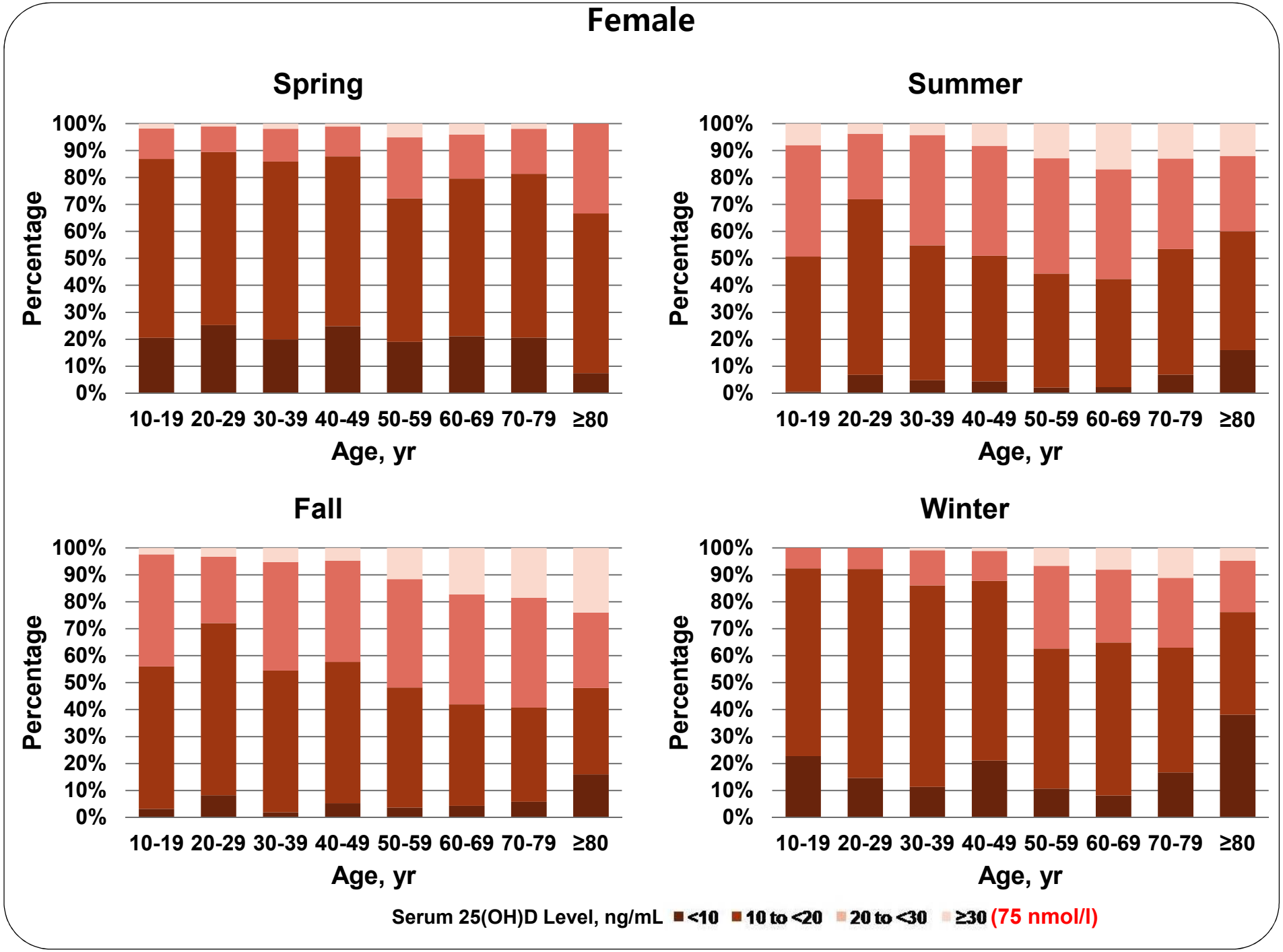
→Vitamin D insufficiency

< 50 nmol/L: 47.3% in men and 64.5% in women

< 75 nmol/L: 86.8% in men and 93.3% in women

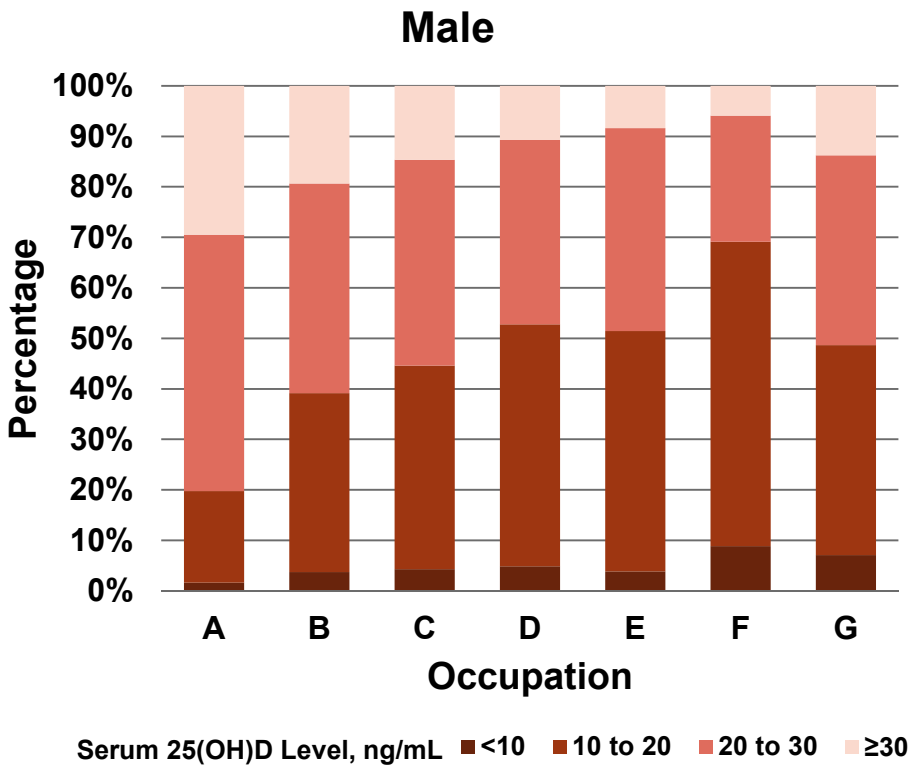
HS Choi et al. J Clin Endocrinol Metab, 93:643-651,2011

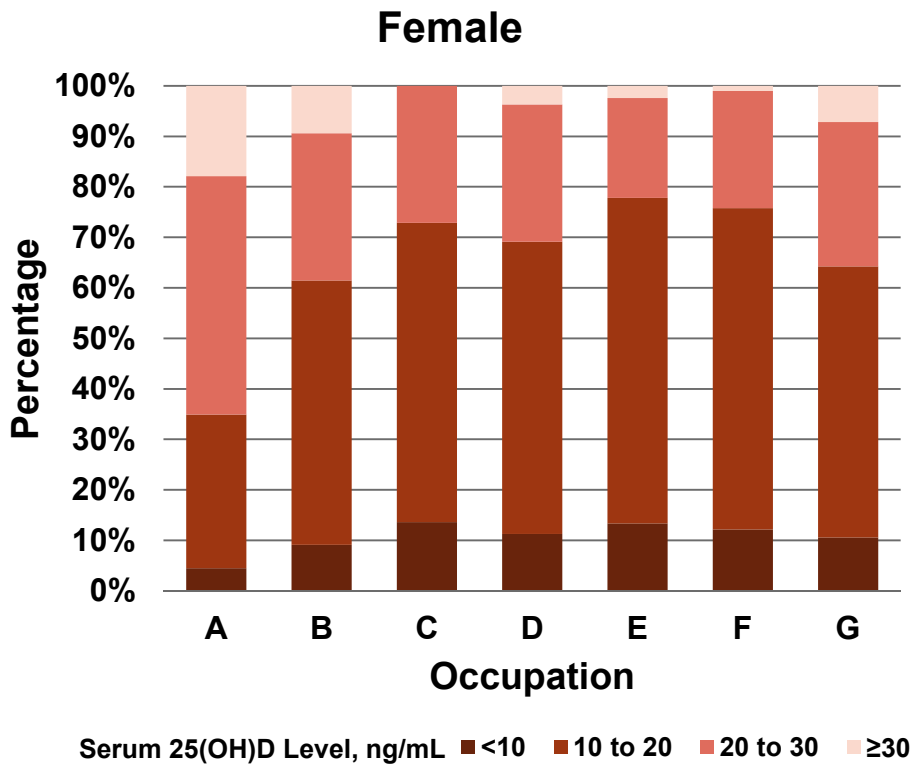

Male
Spring
Summer
Fall
Winter
Percentage
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
10-19 20-29 30-39 40-49 50-59 60-69 70-79 ≥80
Age, yr
Serum 25(OH)D Level, ng/mL <10 10 to <20 20 to <30 ≥30 (75 nmol/l)


Female
Spring
Summer
Fall
Winter
Percentage
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
10-19 20-29 30-39 40-49 50-59 60-69 70-79 ≥80
Age, yr
Serum 25(OH)D Level, ng/mL <10 10 to <20 20 to <30 ≥30 (75 nmol/l)

Prevalence of vitamin D insufficiency by occupation in adults aged 20 yrs or older

The Korea National Health and Nutrition Examination Survey (KNHANES) 2008

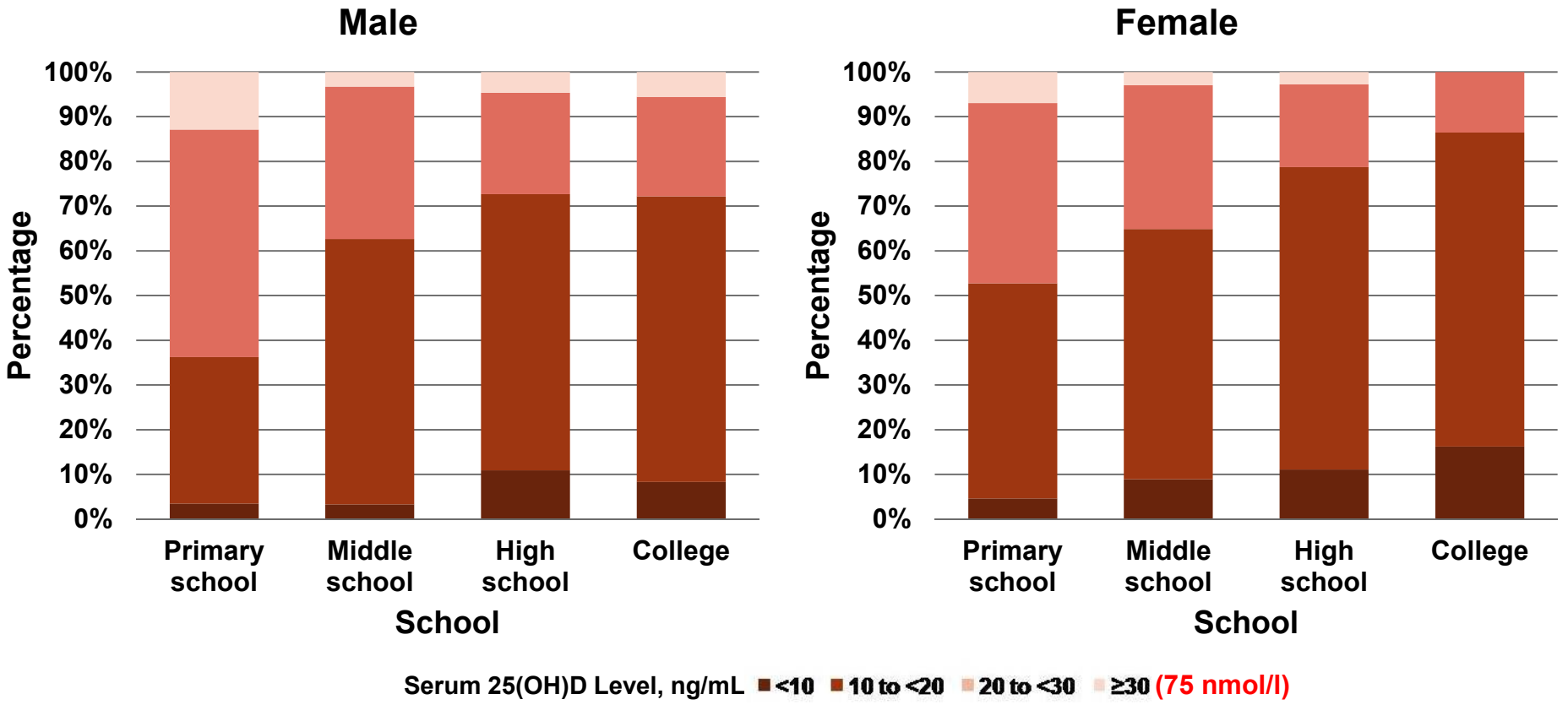




A. Agriculture, forestry, and fishery
B. Manual labor
C. Engineering, assembling, and technical work
D. Sales, and service
E. Administration, clerical work, and specialists
F. Students
G. N/A

HS Choi et al. J Clin Endocrinol Metab, 93:643-651,2011

Prevalence of vitamin D insufficiency by school in participants younger than 20 yrs



Mean 25(OH)D level and the prevalence of vitamin D insufficiency based on nationwide surveys in Korea, the US, and Canada

Country	Survey	Sample size (n)	Age (yr)	Assay	Mean 25(OH)D (nmol/l)	25(OH)D (nmol/l)	
						<50	<75
Korea	KNHANES 2008	6,925 (M:3,047, F:3,878)	10-93	RIA (DiaSorin)	**48.7** (M:52.9, F:45.4)	**56.9%** (M:47.3%, F:64.5%)	**90.5%** (M:86.8%, F:93.3%)
US	NHANES 1988-1994	18,641 (M:8,759, F:9,882)	≥12	RIA (DiaSorin)	**60.7**	**29%** (M:22%, F:35%)	**69%** (M:64%, F:74%)
US	NHANES 2001-2006	23,424 (M:11,443, F:11,981)	≥2	RIA (DiaSorin)	**55.2**	**32%** (M:29%, F:34%)	**76%** (M:76%, F:76%)
Canada	CHMS 2007-2009	5,306 (M:2,566, F:2,740)	6-79	CLIA-LIAISON (DiaSorin)	**67.7** (M:65.7, F:69.7)	-	**64.6%** (M:67.0%, F:62.2%)

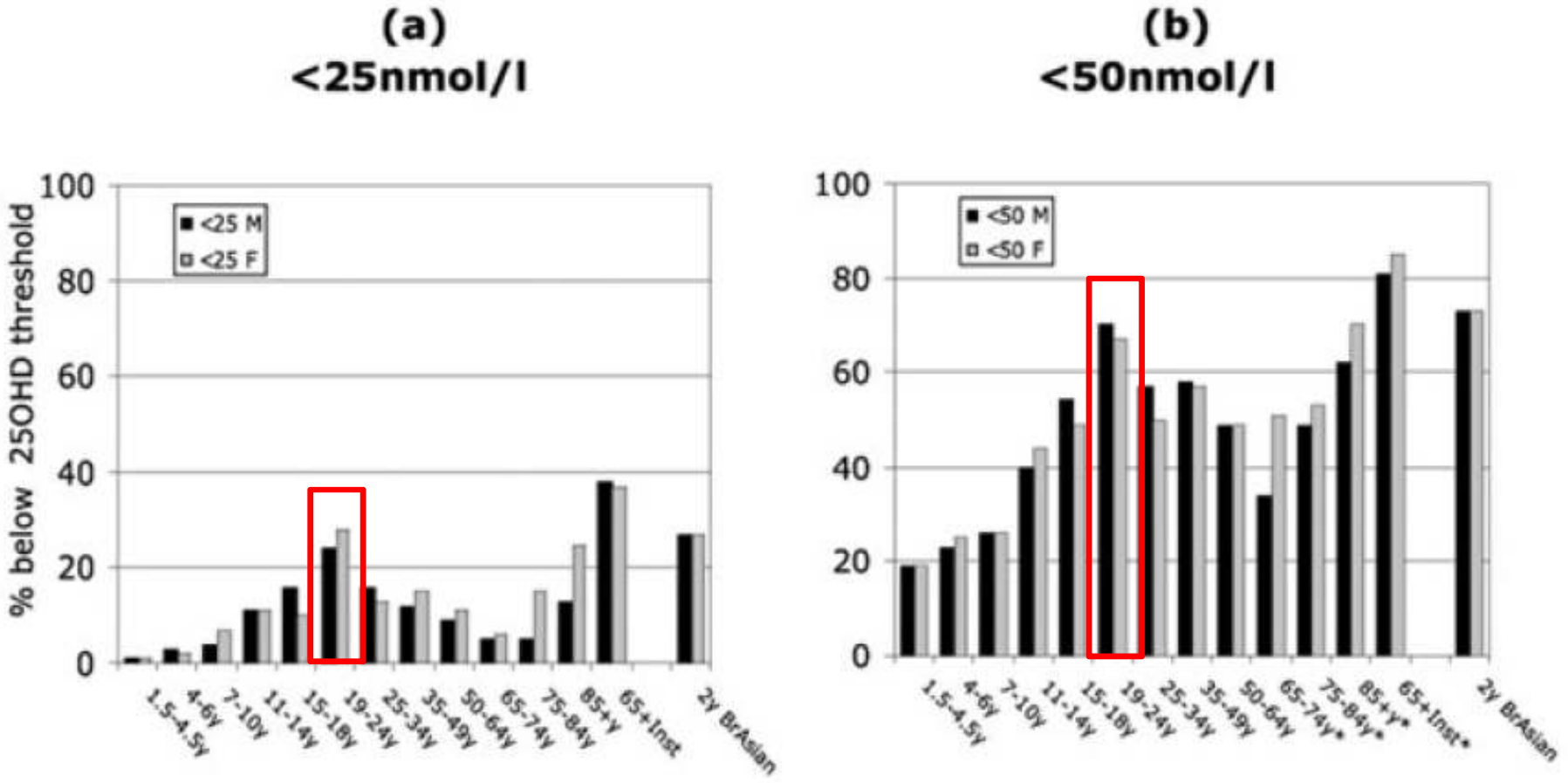
Comparison between the RIA and LIAISON methods showed an average bias of 4.8±16 nmol/L with the LIAISON method giving higher values

HS Choi, Endocrinol Metab 2013;28:12-16

Higher rate of vitamin D insufficiency in younger generation

Is it a unique finding in Korea or recent worldwide trend in the modern epidemic of vitamin D insufficiency ?

The National Diet and Nutrition Survey in the UK 1992–2001



Nutrition Reviews® Vol. 66(Suppl. 2):S153–S164

Canadian Health Measures Survey 2007-2009

Age group and sex	Mean	95% confidence interval	
	Mean nmol/L	from	to
Total 6 to 79 years	**67.7**	**65.3**	**70.1**
Male	65.7*	62.5	68.9
Female	69.7	67.8	71.7
6 to 11 years	**75.0[c d]**	**70.3**	**79.7**
Male	76.8[b c d e]	72.9	80.7
Female	73.1	67.0	79.1
12 to 19 years	**68.1**	**63.8**	**72.4**
Male	65.6*[a]	60.8	70.4
Female	70.8	65.8	75.9
20 to 39 years	**65.0[a e]**	**61.0**	**69.0**
Male	60.7*[a e]	55.3	66.1
Female	69.5	65.8	73.2
40 to 59 years	**66.5[a e]**	**63.8**	**69.2**
Male	66.0[a]	62.1	69.8
Female	67.1[e]	65.0	69.2
60 to 79 years	**72.0[c d]**	**69.4**	**74.5**
Male	70.5[a c]	67.5	73.6
Female	73.3[d]	70.3	76.4

Health Reports, Vol. 21, no. 1, March 2010 • Statistics Canada, Catalogue no. 82-003-XPE

Determinants of vitamin D status

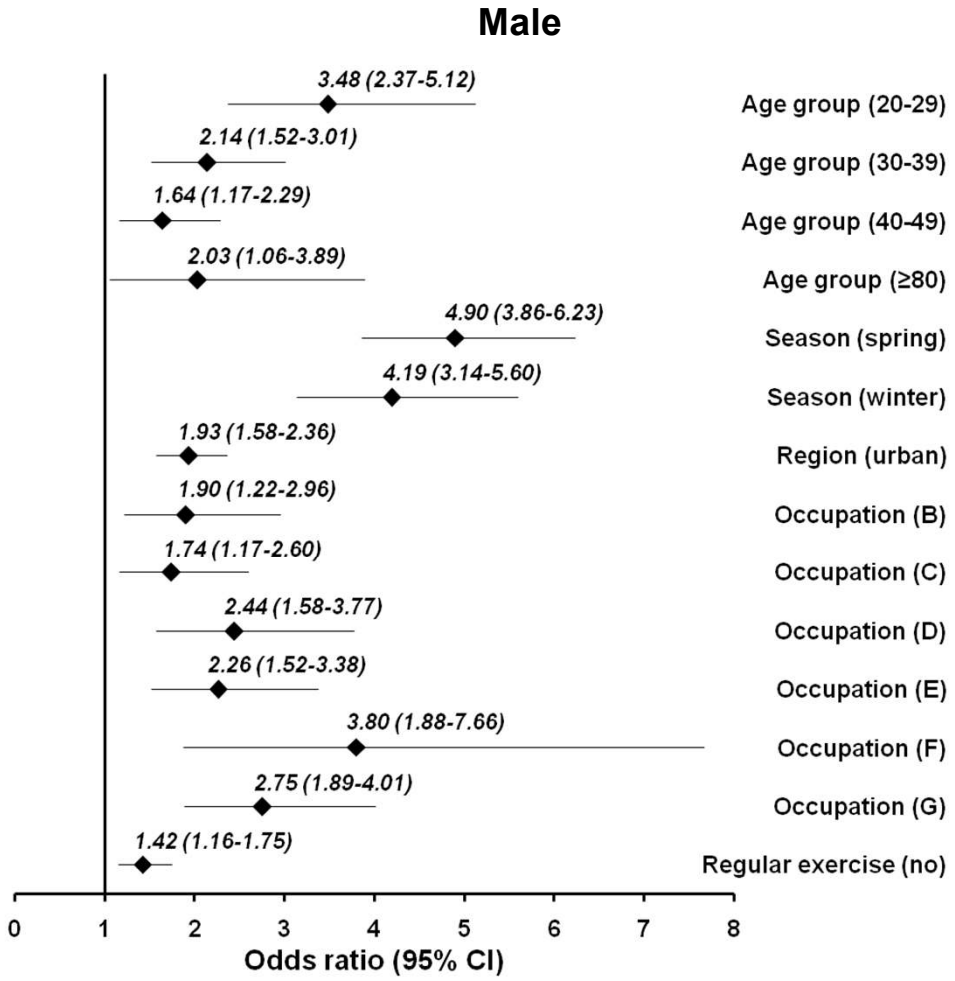
Risk factors for vitamin D insufficiency

- **Older age***
- Female sex
- Lower latitude
- Winter season
- Darker skin pigmentation
- Factors that determine sunlight exposure: clothing and cultural practises, dietary habits, national policies of vitamin D fortification

*The cutaneous production of vitamin D3 declines with age

Mithal et al. Osteoporos Int 20: 1807, 2009

Independent predictors for vitamin D insufficiency in Koreans

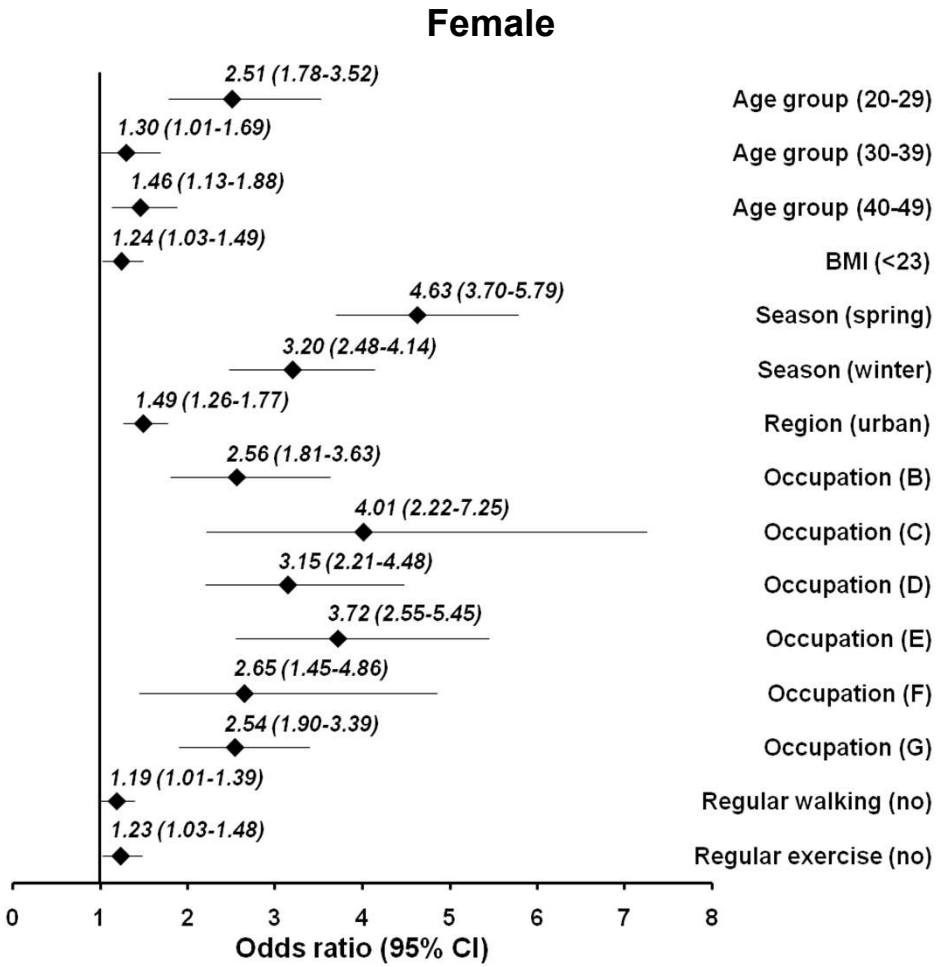


Occupation

A. Agriculture, forestry, and fishery
B. Manual labor
C. Engineering, assembling, and technical work
D. Sales, and service
E. Administration, clerical work, and specialists
F. Students
G. NA

HS Choi et al. J Clin Endocrinol Metab, 93:643-651,2011

Independent predictors for vitamin D insufficiency in Koreans



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D. Sales, and service
E. Administration, clerical work, and specialists
F. Students
G. NA

HS Choi et al. J Clin Endocrinol Metab, 93:643-651,2011

Independent predictors for vitamin D insufficiency in Koreans

- After adjusting for confounders, young age groups were independent predictors for vitamin D insufficiency in our study

- Although the cause of this finding is not clear, it might be due to other behavioral factors of young age groups (indoor lifestyle, sunscreen use, or dietary habits)

Strategies to improve vitamin D status

Sunlight and vitamin D

- Whole body exposure to 10~15 minutes of midday sun in summer [1 MED (minimal erythemal dose)], or the amount of sun exposure which produces a faint redness of skin

  → 15,000 ~ 20,000 IU of vitamin D

- Exposure of hand, face and arms (15% of body surface) to around 1/3 MED

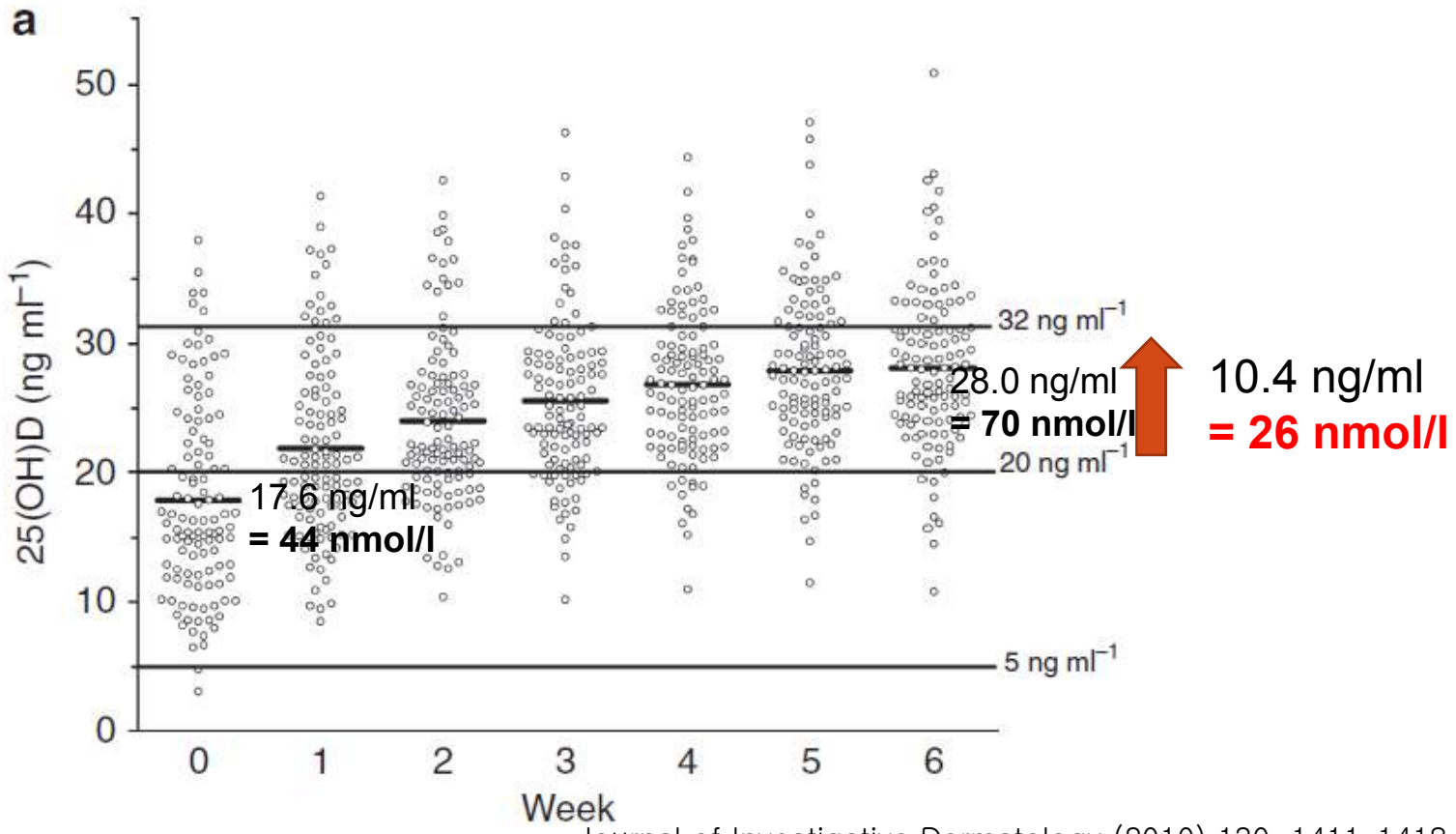
  → 1000 IU of vitamin D

- Holick's rule: ¼ of body to ¼ MED of sunlight

  → 1000 IU of vitamin D

Sunlight and vitamin D

- 120 white Caucasians, aged 20–60 years, from UK (53.51N)
- A simulated summer's sunlight exposures, specifically 1.3 SED (= summer's 13 minutes sunlight exposures), three times weekly for 6 weeks, while wearing T-shirt and shorts (35%)



Journal of Investigative Dermatology (2010) 130, 1411–1418

Sunlight and vitamin D

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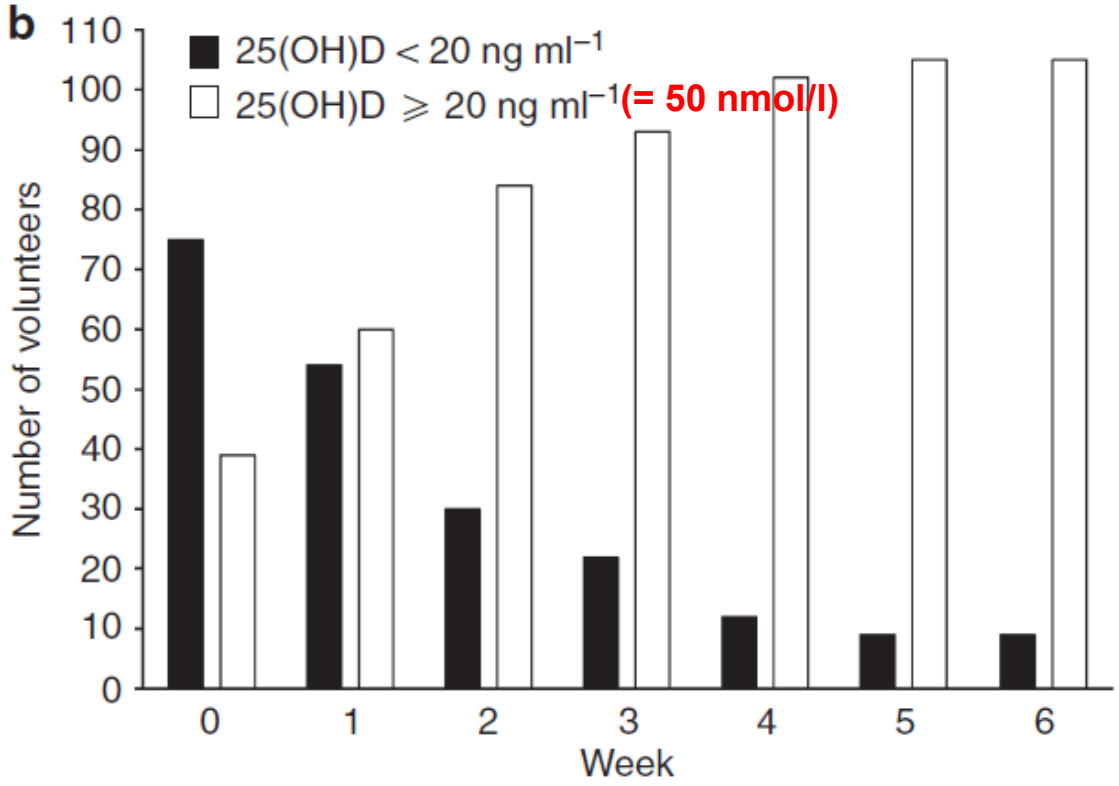


Journal of Investigative Dermatology (2010) 130, 1411–1418

Sunlight and vitamin D

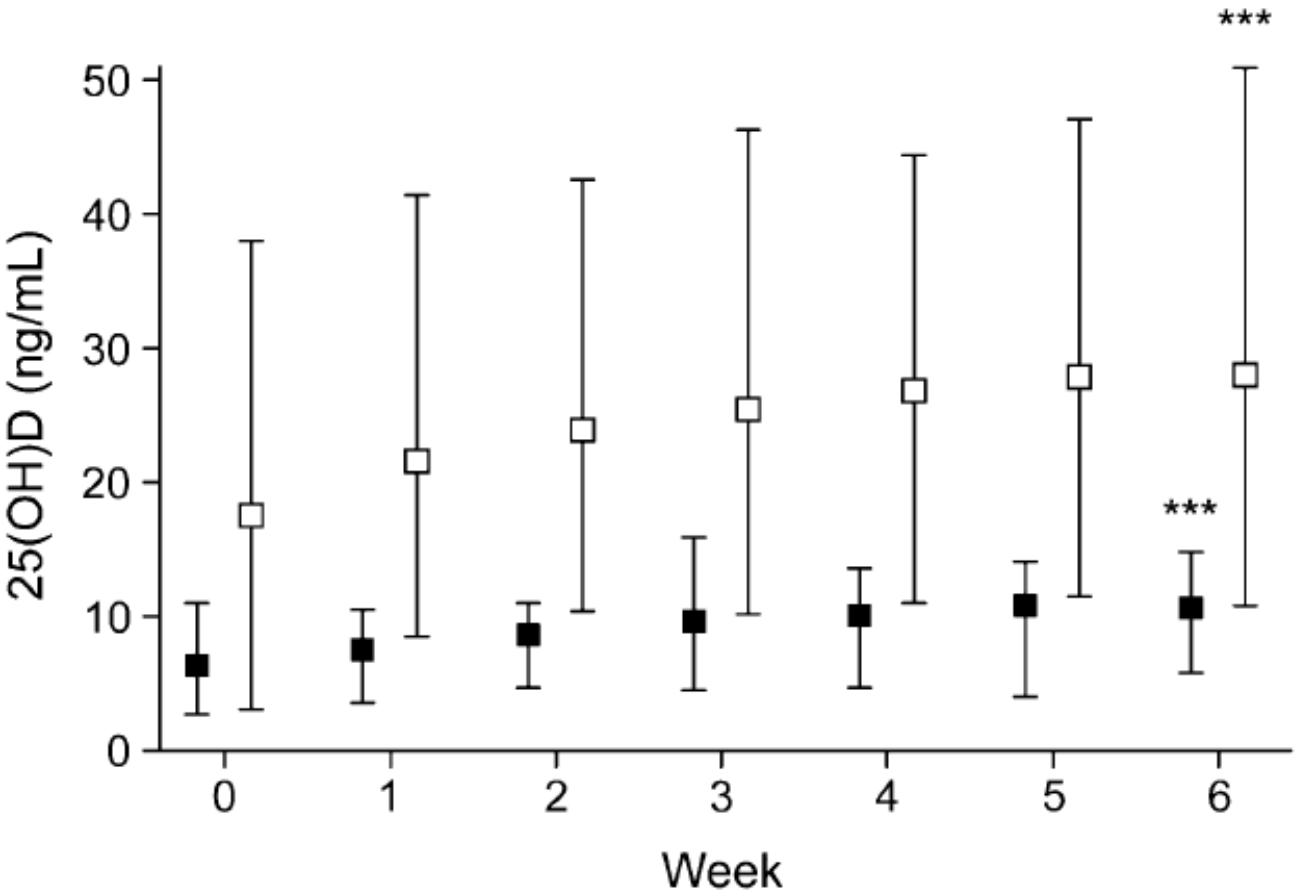
Table 4. Estimated time taken to acquire the same vitamin D-weighted dose as used in this study, at different North American and European locations at local noon on June 21 and December 21

City	Latitude[1] (deg, min)	Summer[2] (minutes)	Winter[2] (minutes)
New Orleans	29, 57	9	39
San Diego	32, 42	9	49
Athens	37, 58	9	—
Washington	38, 53	9	—
Boston	42, 21	10	—
Vancouver	49, 13	11	—
Brussels	50, 52	12	—
Manchester	53, 30	13	—
Oslo	58, 57	16	—

[1]Latitude is given in degrees and minutes.
[2]Times are given to the nearest minute; times >1 h are not shown.

Journal of Investigative Dermatology (2010) 130, 1411–1418

Sunlight and vitamin D



→ White

→ **South Asian (Indian, pakistani,and Bangladeshi) ethnicity**

→ Participants who received exposures 1.95 SEDs (**equivalent to 45 min unshaded sunlight**) attained a mean (6SD) 25(OH)D of 39.25 nmol/l

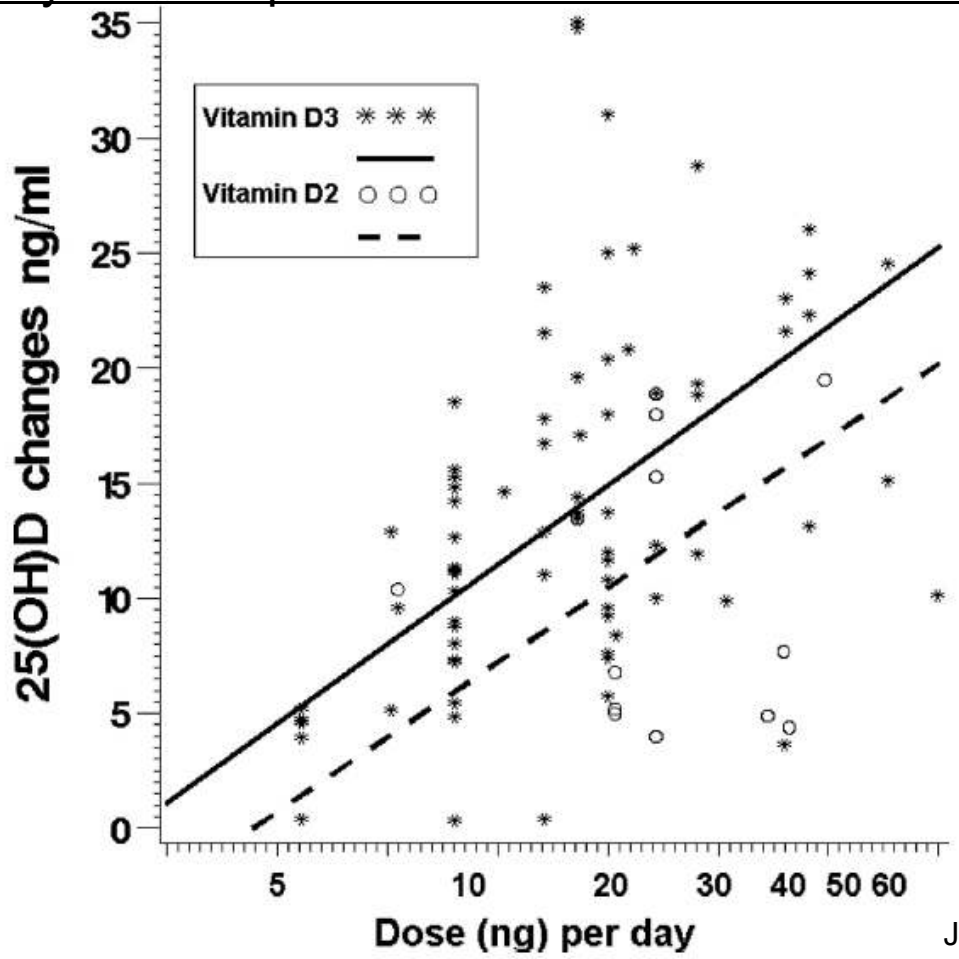
Am J Clin Nutr 2011;94:1219–24; Am J Clin Nutr doi: 10.3945/ajcn.112.052639

Dietary sources

- Fatty fish species
  - Catfish, 85 g provides 425 IU (5 IU/g)
  - Salmon, cooked, 100 g provides 360 IU (3.6 IU/g)
  - Mackerel, cooked, 100 g, 345 IU (3.45 IU/g)
  - Sardines, canned in oil, drained, 50 g, 250 IU (5 IU/g)
  - Tuna, canned in oil, 100 g, 235 IU (2.35 IU/g)
  - Eel, cooked, 100 g, 200 IU (2.00 IU/g)
- A whole egg provides 20 IU (0.33 IU/g)
- Beef liver, cooked, 100 g provides 15 IU (0.15 IU/g)
- Fish liver oils, such as cod liver oil, 15 ml provides 1360 IU (90.6 IU/ml)

Vitamin D Supplementation on Serum 25-Hydroxyvitamin D

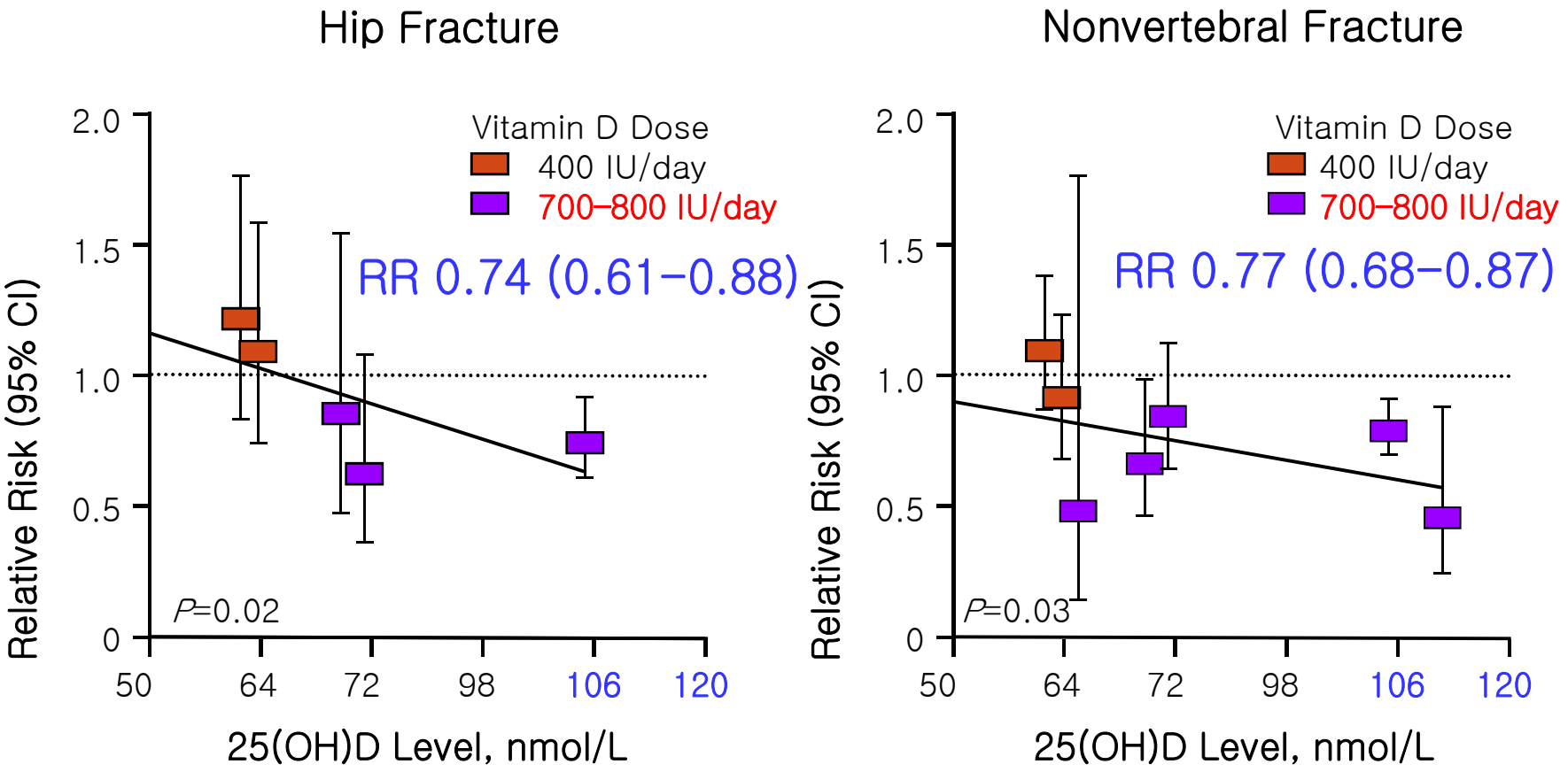
- Meta-analysis of changes in circulating 25-hydroxyvitamin D level associated with vitamin D supplementation in Caucasian subjects over 50 yr old
- Seventy-six trials published from 1984 to March 2011 included 6207 subjects



The average increase in serum 25(OH)D was 0.78 ng/ml (1.95 nmol/liter) per microgram of vitamin D3 supplement (40IU) per day

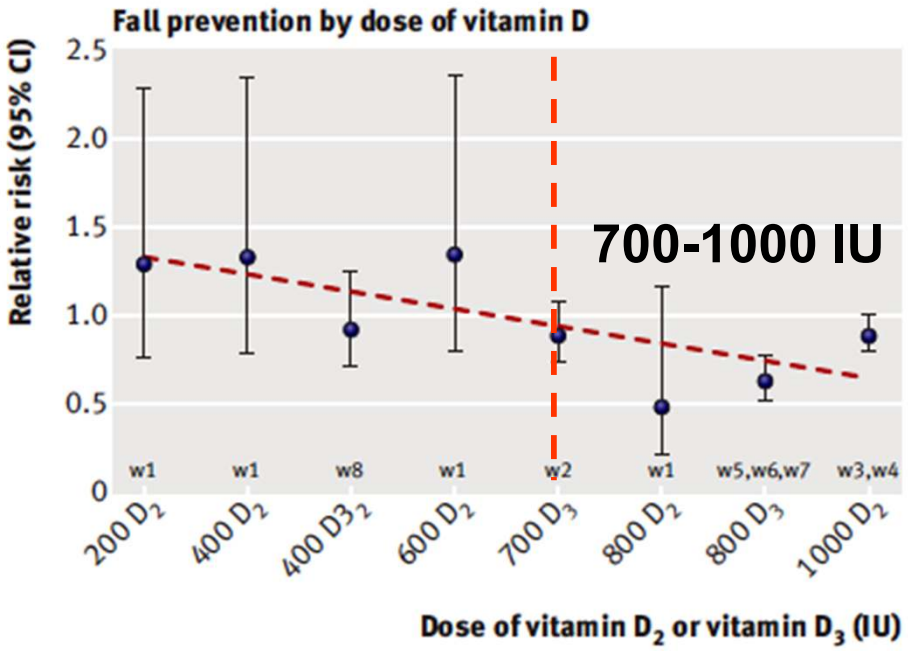
J Clin Endocrinol Metab 97: 2606–2613, 2012

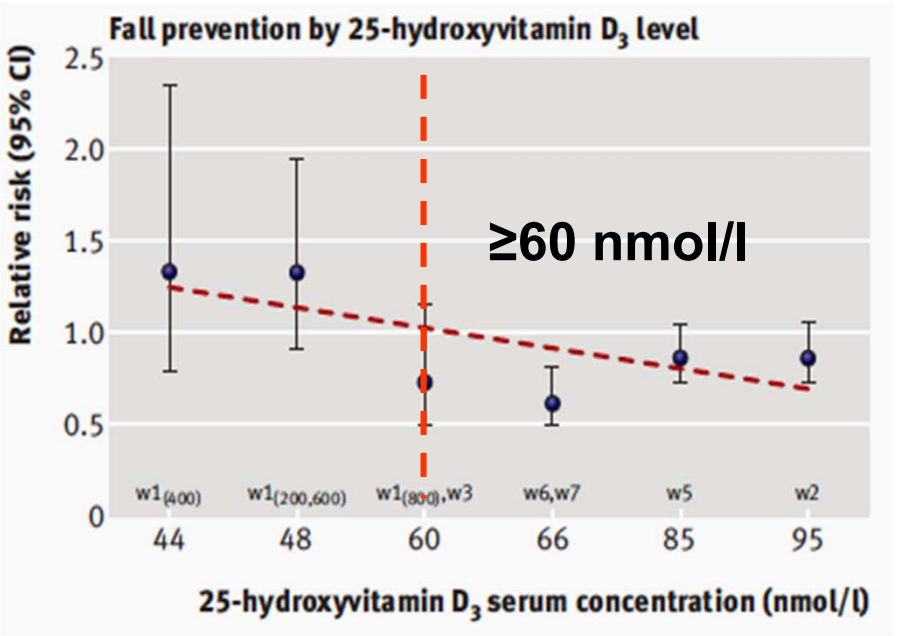
Fracture risk correlated with achieved 25(OH)D levels in RCTs



Bischoff-Ferrari et al. JAMA. 2005; 293:2257–226

Fall prevention by dose and achieved 25(OH)D concentrations



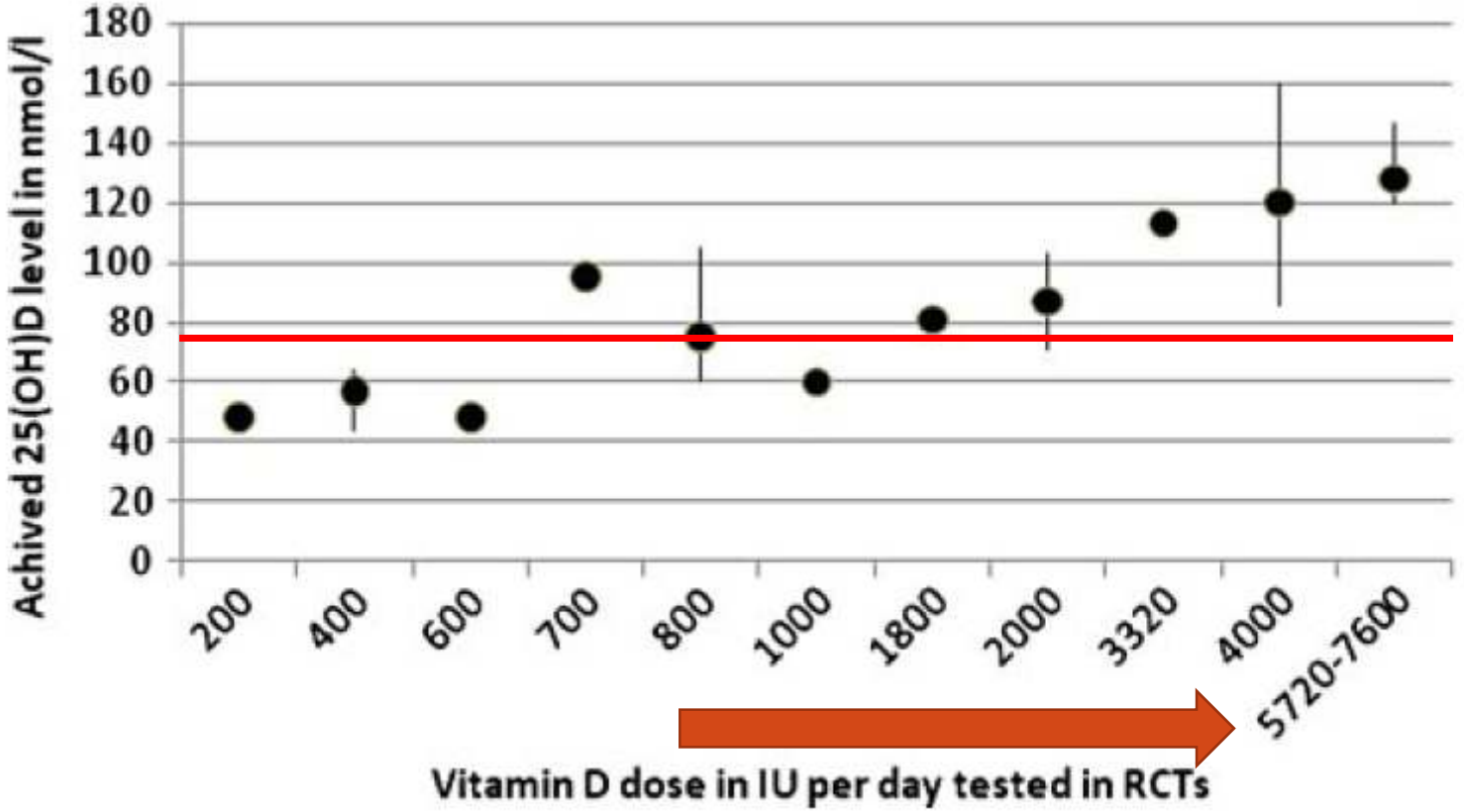


RR 0.81 (0.71-0.92)

RR 0.77 (0.65-0.9)

BMJ 2009;339:b3692

Dose of vitamin D and achieved 25(OH)D levels based on RCTs with a duration of at least 4 weeks



Bischoff-Ferrari et al. Osteoporosis Int 2010;21:1121-1132

Dietary Reference Intakes for Calcium and Vitamin D

NOVEMBER 2010

INSTITUTE OF MEDICINE

OF THE NATIONAL ACADEMIES

TABLE: Dietary Reference Intakes for Calcium and Vitamin D

	Calcium			Vitamin D		
Life Stage Group	Estimated Average Requirement (mg/day)	Recommended Dietary Allowance (mg/day)	Upper Level Intake (mg/day)	Estimated Average Requirement (IU/day)	Recommended Dietary Allowance (IU/day)	Upper Level Intake (IU/day)
Infants 0 to 6 months	*	*	1,000	**	**	1,000
Infants 6 to 12 months	*	*	1,500	**	**	1,500
1–3 years old	500	700	2,500	400	600	2,500
4–8 years old	800	1,000	2,500	400	600	3,000
9–13 years old	1,100	1,300	3,000	400	600	4,000
14–18 years old	1,100	1,300	3,000	400	600	4,000
19–30 years old	800	1,000	2,500	400	600	4,000
31–50 years old	800	1,000	2,500	400	600	4,000
51–70 year old males	800	1,000	2,000	400	600	4,000
51–70 year old females	1,000	1,200	2,000	400	600	4,000
>70 years old	1,000	1,200	2,000	400	800	4,000
14–18 years old, pregnant/lactating	1,100	1,300	3,000	400	600	4,000
19–50 years old, pregnant/lactating	800	1,000	2,500	400	600	4,000

NOF recommendations for vitamin D

- The National Osteoporosis Foundation (NOF) recommends that
  - Adults under age 50 get 400 - 800 IU of vitamin D every day
  - Adults age 50 and older get 800 - 1,000 IU of vitamin D every day
  - Some people may need more vitamin D

한국인 영양섭취기준 2010- 비타민 D

연령	남자				여자			
	평균 필요량	권장 섭취량	충분 섭취량	상한 섭취량	평균 필요량	권장 섭취량	충분 섭취량	상한 섭취량
0~5개월	-	-	200	1,000	-	-	200	1,000
6~11개월	-	-	200	1,000	-	-	200	1,000
1~2세	-	-	200	2,400	-	-	200	2,400
3~5세	-	-	200	2,400	-	-	200	2,400
6~8세	-	-	200	2,400	-	-	200	2,400
9~11세	-	-	200	2,400	-	-	200	2,400
12~14세	-	-	200	2,400	-	-	200	2,400
15~18세	-	-	200	2,400	-	-	200	2,400
19~29세	-	-	200	2,400	-	-	200	2,400
30~49세	-	-	200	2,400	-	-	200	2,400
50~64세	-	-	400	2,400	-	-	400	2,400
65~74세	-	-	400	2,400	-	-	400	2,400
75세 이상	-	-	400	2,400	-	-	400	2,400
임신부	-	-	-	-	-	-	-	-
수유부	-	-	-	-	-	-	-	-

한국영양학회, 한국인 영양섭취기준 개정판, 2010

Conclusions

- The prevalence of vitamin D insufficiency, defined as a serum 25-hydroxyvitamin D [25(OH)D] level below 50 nmol/L, was 47.3% in males and 64.5% in females
- Only 13.2% of males and 6.7% of females had a serum 25(OH)D level of greater than 75 nmol/L
- In Korea, vitamin D insufficiency was more prevalent in young adults than in elderly people, likely due to the indoor lifestyle of younger people

Conclusions

- Compared with the United States and Canada, Korea has a lower mean 25(OH)D level and a higher prevalence of vitamin D insufficiency

- To improve the vitamin D status of the Korean population, more aggressive policies on food fortification and vitamin D supplementation are needed