



세미나 | 제 2 세미나실

한국인의 칼슘과 비타민 D의 섭취실태와 가이드라인

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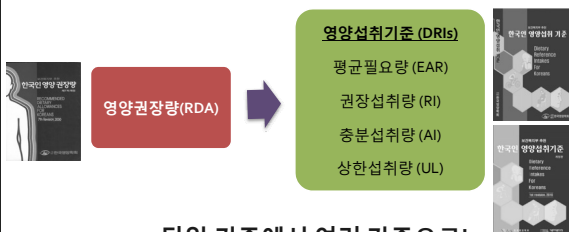
영양섭취기준이란

- 영양섭취기준은 건강한 정상적인 대다수 국민의 영양필요량을 충족시키기 위하여 전문가들이 과학적 근거를 토대로 영양소별로 설정 한다.
- 영양섭취기준은 과학적으로 밝혀진 사실에 기초하여 책정하며, 우리나라 사람들의 체위, 활동 정도에 맞추어 조절되어야 하기 때문에 연령, 성별에 따른 대표 체위를 선정하여 그에 맞는 영양소 섭취 기준을 설정하게 된다.



한국인 영양섭취기준

- 한국영양학회는 2005년에 국제적 추세와 우리나라 국민의 식생활과 질병양상의 변화를 반영하여 기존의 영양권장량에서부터 범위와 내용을 확대한 새로운 한국인 영양섭취기준을 제정하였다.



단일 기준에서 여러 기준으로!

영양섭취기준의 종류

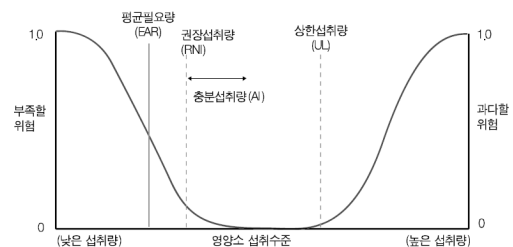


그림 1-1. 영양섭취기준(Dietary Reference Intakes: DRIs)

2010 영양섭취기준이 설정된 영양소

영양소	영양섭취기준			
	평균필요량	관장섭취량	충분섭취량	상한섭취량
에너지	○			
다량 영양소	○	○		
단백질	○	○		
지방	○	○		
식이섬유			○	
수분			○	
비타민 A	○	○		○
비타민 D	○	○		○
비타민 E	○	○		
비타민 K	○	○		
수용성 미네랄	○	○		○
비타민 C	○	○		
칼슘	○	○		
리보플라빈	○	○		
나이아신	○	○		
비타민 B6	○	○		
엽산	○	○		
비타민 B12	○	○		
판토텐산			○	
다량 무기질	○	○		○
칼륨	○	○		
나트륨			○	○
마그네슘			○	
인			○	
아연			○	
구리			○	
셀레늄			○	
망간			○	
몰리브덴			○	
코발트			○	
비타민 B12			○	
비타민 B12			○	

DRIs for Calcium

Korea					Japan				
성별	연령	평균 필요량 (mg/일)	관장 섭취량 (mg/일)	충분 섭취량 (mg/일)	성별	연령	추정평균필요량 (EAR) (mg/일)	권장섭취량 (RDA) (mg/일)	내용상한량 (UL) (mg/일)
영아	0-5개월	200			남자	6-8세	500	500	2500
유아	1-2세	300	500	2500	남자	9-11세	670	800	2500
	3-5	470	600	2500	남자	12-14	800	1000	2500
	6-11	580	700	2500	남자	15-18	750	900	2500
	12-14	800	1000	2500	남자	19-29	620	750	2500
	15-18	750	900	2500	남자	30-49	600	750	2500
	19-29	620	750	2500	남자	50-64	570	700	2500
	30-49	600	750	2500	남자	65-74	560	700	2500
	50-64	570	700	2500	남자	75 이상	560	700	2500
	65-74	560	700	2500	남자	8-11	350	400	2500
	75 이상	560	700	2500	남자	1-2세	300	400	2500
여자	6-8세	580	700	2500	남자	3-5	500	600	2500
여자	9-11	670	800	2500	남자	6-7	500	600	2500
여자	12-14	740	900	2500	남자	8-9	550	650	2500
여자	15-18	660	800	2500	남자	10-11	600	700	2500
여자	19-29	530	650	2500	남자	12-14	650	800	2500
여자	30-49	510	650	2500	남자	15-17	650	800	2500
여자	50-64	580	700	2500	남자	18-29	600	800	2500
여자	65-74	570	700	2500	남자	30-49	550	650	2500
여자	75 이상	570	700	2500	남자	50-69	550	650	2500
임신부		+230	+280	2500	남자	70 이상	500	600	2500
수유부		+310	+370	2500	남자	70 이상	500	600	2500

한국인영양섭취기준, 한국영양학회, 2010

DRIs for Vitamin D

Korea					Japan				
성별	연령	평균 필요량 (µg/일)	관장 섭취량 (µg/일)	충분 섭취량 (µg/일)	성별	연령	추정평균필요량 (EAR) (µg/일)	권장섭취량 (RDA) (µg/일)	내용상한량 (UL) (µg/일)
영아	0-5개월	5	25	25	남자	0-5개월	2,500.0 ^a	25 ^b	25 ^b
	6-11	5	25	25	남자	6-11	5,005.0 ^b	25 ^b	25 ^b
유아	1-2세	5	60	60	남자	1-2세	2.5	25	30
	3-5	5	60	60	남자	3-5	2.5	30	30
	6-11	5	60	60	남자	6-7	2.5	30	30
남자	6-8세	5	60	60	남자	8-9	3.0	35	35
	9-11	5	60	60	남자	10-11	3.5	35	35
	12-14	5	60	60	남자	12-14	3.5	45	45
	15-18	5	60	60	남자	15-17	4.5	50	50
	19-29	5	60	60	남자	18-29	5.5	50	50
	30-49	5	60	60	남자	30-49	5.5	50	50
	50-64	10	60	60	남자	50-69	5.5	50	50
	65-74	10	60	60	남자	70 이상	5.5	50	50
	75 이상	10	60	60	남자	0-5개월	2,505.0	25	25
여자	6-8세	5	60	60	남자	6-11	5,005.0	25	25
여자	9-11	5	60	60	남자	1-2세	2.5	25	25
여자	12-14	5	60	60	남자	3-5	2.5	30	30
여자	15-18	5	60	60	남자	6-7	2.5	30	30
여자	19-29	5	60	60	남자	8-9	3.0	35	35
여자	30-49	5	60	60	남자	10-11	3.5	35	35
여자	50-64	10	60	60	남자	12-14	3.5	45	45
여자	65-74	10	60	60	남자	15-17	4.5	50	50
여자	75 이상	10	60	60	남자	18-29	5.5	50	50
임신부		+5	60	60	남자	30-49	5.5	50	50
수유부		+5	60	60	남자	50-69	5.5	50	50
					남자	70 이상	5.5	50	50

한국인영양섭취기준, 한국영양학회, 2010

미국의 영양섭취기준

Life Stage Group	Calcium			Vitamin D		
	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)
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	800	1,000	2,000	400	600	4,000
51-70 year old females	1,000	1,200	2,000	400	600	4,000
71+ years old	1,000	1,200	2,000	400	800	4,000

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Dietary Reference Intake

	Calcium	Vitamin D
Korea	EAR, RNI, UL	AI, UL
Japan	EAR, RDA, UL	AI, UL
USA	EAR, RDA, UL	EAR, RDA, UL

Dietary Reference Intakes for Calcium and Vitamin D, 2011



Year	Calcium AI	Vitamin D AI
1997	<ul style="list-style-type: none"> uncertainties associated with balance studies, lack of concordance between observational and experimental data, lack of longitudinal data to verify the relationship between calcium intake, calcium retention and bone loss 	<ul style="list-style-type: none"> inadequate data available for EARs and RDAs as a result of uncertainties about sun exposure, the vitamin D content of the diet, and vitamin D stores
2011	EAR, RDA, UL	EAR, RDA, UL



Calcium

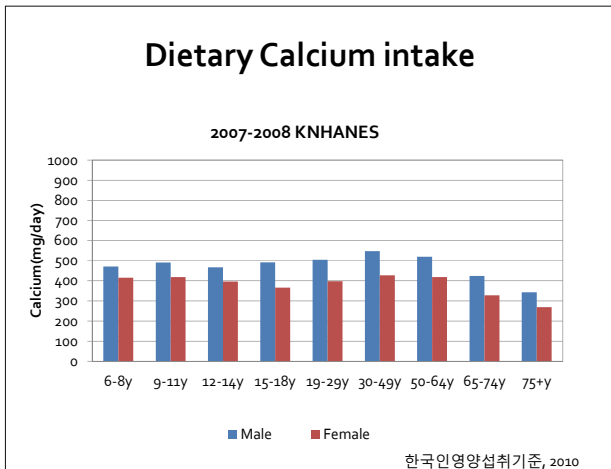
- 칼슘의 영양섭취기준은 1세 이상 모든 연령층에서 평균필요량, 권장 섭취량, 상한섭취량을 설정
- 필요량 추정에 사용될 수 있는 지표
 - 혈중 칼슘 농도
 - 철저하게 조절되므로 바람직한 지표가 아님!
 - 평형연구에 의한 칼슘보유율
 - 요인가산법에 의한 필요량 측정치
 - 골밀도와 골무기질 함량
- 우리나라 영양섭취기준 산정에 사용한 지표
 - 성인: 칼슘 섭취량과 손실량의 평형연구 결과를 통해 산출
 - 성장기 아동과 청소년: 골격 성장 평균치 도달을 위한 체내 칼슘 축적량에 중점을 두어 요인가산법으로 산출
 - 노년: 골질량 감소 및 골다공증 예방을 목적으로 산출

Calcium Requirement

- Ca balance study
 - 19편 대사실험
 - 성인 155명
 - 373회 측정

FIGURE 2. Relation between calcium output (fecal calcium + urinary calcium excretion) and calcium intake, both expressed as mg · kg body wt⁻¹ · d⁻¹, for women (●; n = 73; weight: 77.1 ± 18.5 kg; age: 47.0 ± 18.5 y (range: 20–75 y)) and men (○; n = 81; weight: 76.6 ± 12.6 kg; age: 28.2 ± 7.7 y (range: 19–64 y)) who participated in tightly controlled feeding studies conducted in a metabolic unit (373 observations). Data were modeled by using a linear mixed-effect model. Calcium output (urinary + fecal) increased linearly with increases in calcium intake (P = 0.0001). Across all subjects, neutral calcium balance (defined as calcium output F equal to calcium intake C) was maintained at calcium intakes of 9.39 mg · kg body wt⁻¹ · d⁻¹ (F = 1.44 + 0.85C). Solid thin lines indicate 95% CIs around the regression line. Dotted lines indicate the 95% prediction interval.

AJCN 2008;86:1054-1063



Vitamin D

- 비타민 D의 영양섭취기준은 모든 연령층에서 **충분섭취량**과 **상한섭취량**으로 설정
 - 비타민 D는 최저 필요량 설정에 관한 확실한 근거가 부족하고 햇빛에 노출되면 생합성 되는 특수성으로 인하여 식품으로부터 공급하는 권장량을 설정하는 것이 어려우므로 많은 다른 나라에서와 같이 우리나라의 경우에도 충분섭취량을 기준으로 하였다.

Clinical Practice Guideline

SPECIAL FEATURE
Clinical Practice Guideline

Evaluation, Treatment, and Prevention of Vitamin D Deficiency: an Endocrine Society Clinical Practice Guideline

Michael F. Holick, Neil C. Binkley, Heike A. Bischoff-Ferrari, Catherine M. Gordon, David A. Hanley, Robert P. Heaney, M. Hassan Murad, and Connie M. Weaver

Boston University School of Medicine (M.F.H.), Boston, Massachusetts 02118; University of Wisconsin (N.C.H.), Madison, Wisconsin 53706; University Hospital Zurich (H.A.B.), CH-8097 Zurich, Switzerland; Children's Hospital Boston (C.M.G.), Boston, Massachusetts 02115; University of Calgary Faculty of Medicine (D.A.H.), Calgary, Alberta, Canada T2N 1N6; Creighton University (R.P.H.), Omaha, Nebraska 68178; Mayo Clinic (M.H.M.), Rochester, Minnesota 55905; and Purdue University (C.M.W.), West Lafayette, Indiana 47907

Objective: The objective was to provide guidelines to clinicians for the evaluation, treatment, and prevention of vitamin D deficiency with an emphasis on the care of patients who are at risk for deficiency.

Participants: The Task Force was composed of 6 chairs, six additional experts, and a methodologist. The Task Force received no corporate funding or remuneration.

Consensus Process: Consensus was guided by systematic reviews of evidence and discussions during several conferences via audio-mail communications. The draft prepared by the Task Force was reviewed successively by The Endocrine Society's Clinical Guidelines Subcommittee, Clinical Affairs Core Committee, and supporting associations, and it was posted on The Endocrine Society website for member review. At each stage of review, the Task Force received further comments and incorporated needed changes.

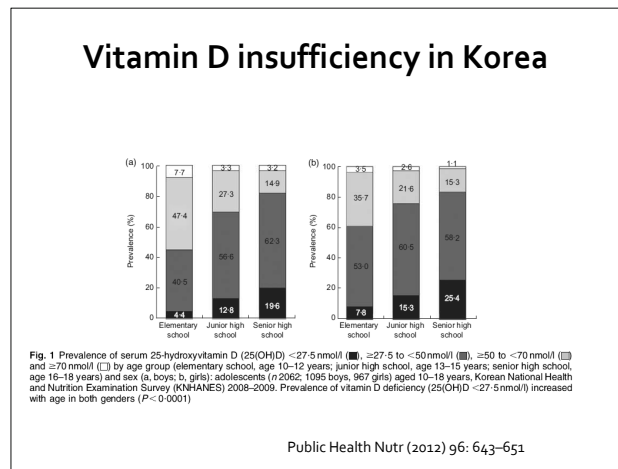
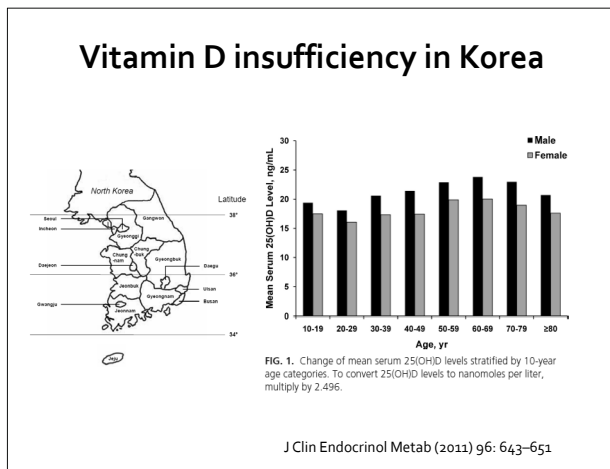
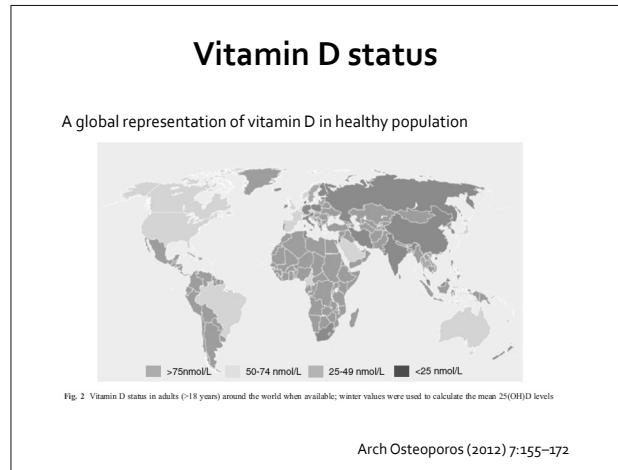
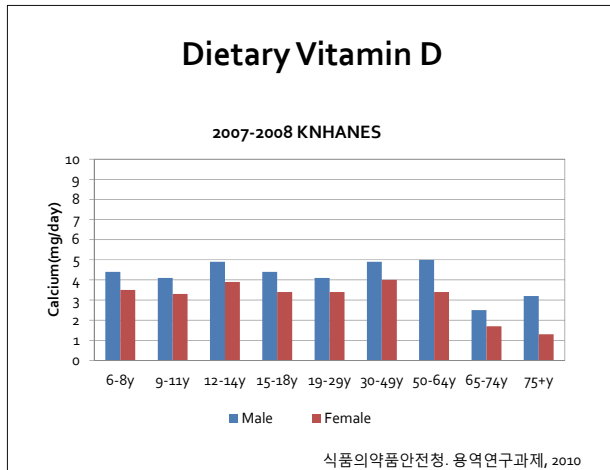
Conclusions: Considering that vitamin D deficiency is very common in all age groups and that few foods contain vitamin D, the Task Force recommended supplementation at suggested daily intake and tolerable upper limit levels, depending on age and clinical circumstances. The Task Force also suggested the measurement of serum 25-hydroxyvitamin D level by a reliable assay as the initial diagnostic test in patients at risk for deficiency. Treatment with either vitamin D₂ or vitamin D₃ was recommended for deficient patients. At the present time, there is not sufficient evidence to recommend screening individuals who are not at risk for deficiency to prophylactically maintain the nonskeletal benefits for cardiovascular protection. *J Clin Endocrinol Metab* 96: 1911-1930, 2010

Diagnostic procedure

- Recommend the serum circulating **25(OH)D** level to evaluate vitamin D status

	25(OH)D	
Deficiency	< 20 ng/ml	< 50 nmol/L
Insufficiency	21-29	52.5-72.5

J Clin Endocrinol Metab (2011)96:1911-30



- ### Predictors of Vitamin D levels
- Total vitamin D intake from food and supplement
 - Regional solar irradiance/Season
 - Age
 - Gender
 - Ethnicity
 - Physical activity
 - Obesity
 - Possibly female hormone for women
 - Possibly alcohol intake

Framingham Offspring Study

Predictors of 25-hydroxyvitamin D score (n = 805)

Predictors	Estimate	P
Intercept	10.57	0.127
Age (y)	-0.02	0.790
Sex (male vs female)	3.61	0.003
BMI (kg/m ²) ¹	395.23	<0.001
Total energy intake (kJ/d)	-0.0007	<0.001
Smoking		
Nonsmoker	11.45	0.002
<20 cigarettes/d	11.00	0.009
≥20 cigarettes/d	Reference	
Total vitamin D intake (μg/d) ¹	4.85	<0.001
Month of blood sampling		
January	1.67	0.52
February	-4.05	0.09
March	-1.88	0.41
April	-3.31	0.16
May	5.50	0.05
June	19.13	<0.001
July	19.22	<0.001
August	19.04	<0.001
September	4.12	0.16
October	6.51	0.005
November	4.99	0.04
December	Reference	

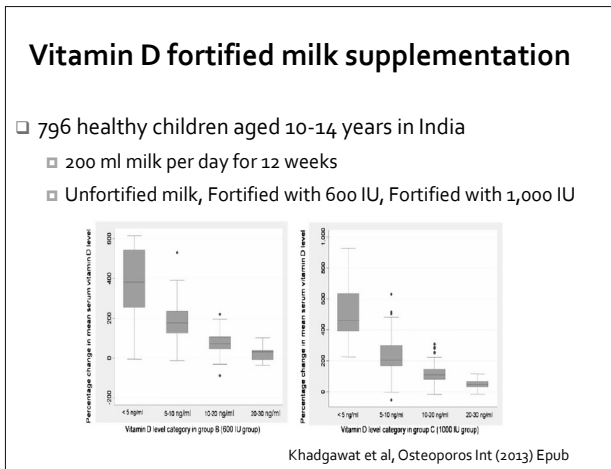
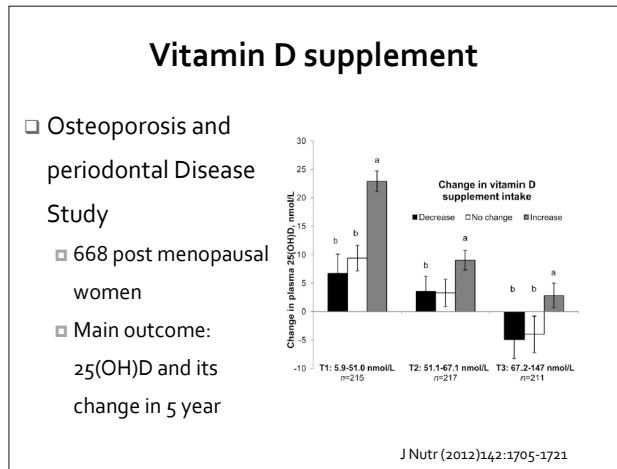
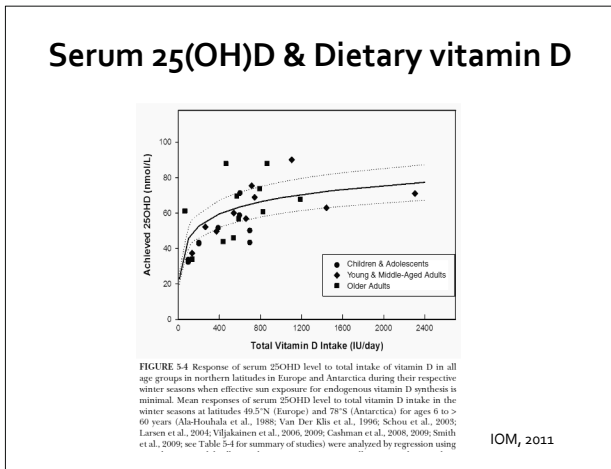
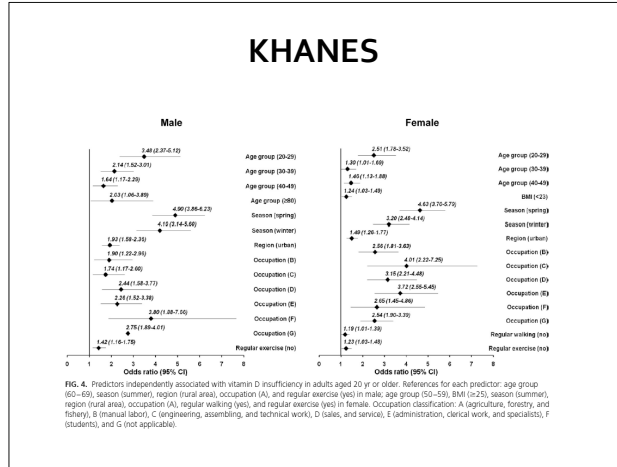
Am J Clin Nutr (2010) 91:1627-33.



Women's Health Initiative Trial

Independent variable	No. of subjects	Final 25(OH)D predictive model ^a			
		β -coefficient (SE)	P value	Partial R ²	Model R ²
Month of blood draw					
January	260	Reference	<.0001	0.03	0.05
February	226	0.26 (1.96)			
March	244	1.93 (1.93)			
April	280	2.52 (1.89)			
May	230	2.32 (2.05)			
June	300	7.60 (1.87)			
July	281	10.37 (1.90)			
August	248	12.15 (2.02)			
September	242	10.27 (2.07)			
October	276	10.23 (1.94)			
November	234	4.68 (1.99)			
December	234	5.22 (1.96)			
Total vitamin D intake, energy-adjusted ($\mu\text{g}/\text{kJ}^{0.75}$)	2865	5.05 (0.34)	<.0001	0.07	0.12
Waist circumference (cm) ^b	3054	-0.36 (0.03)	<.0001	0.05	0.17
Recreational physical activity (MET-h/wk) ^c	2731	0.21 (0.03)	<.0001	0.01	0.19
Race-ethnicity			<.0001	0.01	0.20
White	2726	Reference			
African American	164	-11.37 (1.92)			
Hispanic	76	-9.22 (2.70)			
Asian/Pacific Islander	51	-8.07 (3.14)			
American Indian/unknown	38	-2.68 (3.56)			
Langlays [(g-cm) per cm ²]	3055	0.04 (0.007)	<.0001	0.01	0.21
Age (yr)	3055	2.59 (1.00)	0.01		

Am J Clin Nutr (2010)91:1324-35



Summary

- Different indicators were used to establish DRIs for Calcium and vitamin D
- High vitamin D insufficiency in Korean population
- Further research to establish EAR, RI for vitamin D in Korean population