



Berne, September 2012

Vitamin D Supplements: Evidence for Mother and Children



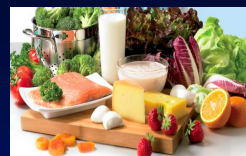
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Can Bone Mineral Mass Trajectory be Changed ? Nutritional Factors:

Calcium, Protein, Vitamin D



Rationale



Risk ↑

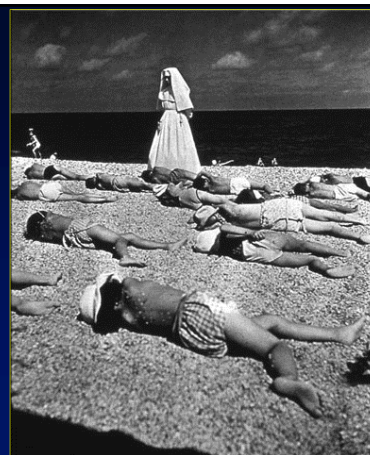
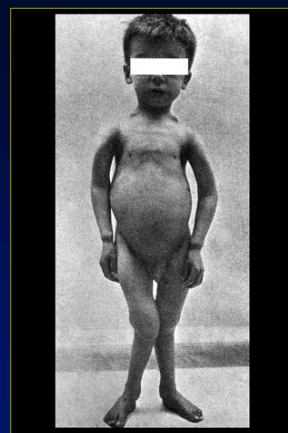
- Preeclampsia
- Pre-term birth/ C-Section
- Gestational diabetes



Risk ↑

- Reduced birth weight
- Reduced bone density during childhood
- Rickets
- Auto-immune diseases
- Diabetes / Asthma

Bodnar, L.M., et al., Maternal vitamin D deficiency increases the risk of preeclampsia. J Clin Endocrinol Metab, 2007



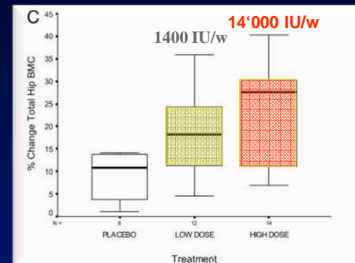


Intervention studies in children BONE health

- Supplementation with 100, 200, or 400 IU/d of vitamin D resulted in the **prevention of rickets** in one study (Specker BL 1992)
- Intakes between 340– 600 IU/d reported to have the maximum **effect on linear growth of infants** (Feliciano ES 1994)
- 2011 meta-analysis of 4 double-blind RCTs of vitamin D supplementation in the range of 132 to 2000 IU vitamin D per day compared to control (placebo or lower dose) in 639 children suggested **small effect on lumbar spine bone mineral density** in all treated children (standardized mean difference 0.15, 95% confidence interval -0.01 to 0.31; P=0.07); and a significant benefit of vitamin D supplementation in children with serum 25(OH)D below 35 nmol/l (Winzenberg T 2011)
- In one randomized trial among Lebanese girls age 10 to 17 included in this most recent meta-analysis, **hip bone density increased** more with 14'000 IU vitamin D per week (2000 IU/day) compared to 1400 IU/week (200 IU/day) at 12 month follow-up without any report of toxicity, and irrespective of baseline 25(OH)D levels (El-Hajj Fuleihan G 2006)

Effect of vitamin D treatment on hip BMD in premenarcheal girls

N = 72; girls age 10-17; double-blind RCT over 1 year



Ghada El-Hajj Fuleihan et al; J Clin Endocrinology and Metabolism 2006



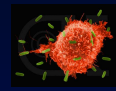
Mechanism: vitamin D benefit on glucose metabolism?



- Risk reduction was 26% with cod liver oil**
(Stene LC, Joner G. Use of cod liver oil during the first year of life is associated with lower risk of childhood-onset type 1 diabetes: a large, population-based, case-control study. Am J Clin Nutr. 2003;78(6):1128-34)
- Risk reduction was 33% with general vitamin D supplementation**
(Vitamin D supplement in early childhood and risk for Type 1 (insulin-dependent) diabetes mellitus. The EURODIAB Substudy is a multi-centre case-control study. Diabetologia. 1999;42(1):51-4)
- 78% with 2000 IU per day vitamin D supplementation**
(Hypponen E, Laara E, Reunanen A, Jarvelin MR, Virtanen SM. Intake of vitamin D and risk of type 1 diabetes: a birth-cohort study. Lancet. 2001;358(9292):1500-3)



Other Small double-blind RCT in children



1100 IU D3 /d vs placebo in schoolchildren in Japan during winter season (n = 334)

Results:

- 46% less influenza A**
- In children with a previous diagnosis of asthma, 83% less asthma attacks**

Urashima M. et al.; Am J Clin Nutr. 2010



Institute of Medicine (IOM) Recommendations for pregnant women / early life November-2010



Pregnancy

- Threshold 25(OH)D: 50 nmol/l = 20 ng/ml
- RDI: 600 IU / day
- Safe upper limit: 4000 IU/Tag

Early life

- Threshold 25(OH)D: 50 nmol/l = 20 ng/ml
- RDI: 400 IU / day in the first year – then 600 IU

<http://www.iom.edu/Reports/2010/Dietary-Reference-Intakes-for-Calcium-and-Vitamin-D/DRI-Values.aspx>



US Endocrine Taskforce on Vitamin D US Endocrine Society June-2011



Guidelines on Prevention and Treatment of Vitamin D Deficiency

- Threshold 25(OH)D: 75 nmol/l = 30 ng/ml
- Pregnancy – high risk group for vitamin D deficiency – test
- 600 IU/d insufficient to correct deficiency in pregnant women
- Prevention during pregnancy:**
 - 400 IU vitamin D from a multi-vitamin **PLUS** 1000 IU /d
- Safe upper limit: 10'000 IU/d age 19+ (< 5000 IU/d)

Lactation:

- Mother's requirement (1500 – 2000 IU/day)
- Mother for child's requirement (2000-4000 IU/day)

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

Vitamin D deficiency: Evidence, safety, and recommendations for the Swiss population

Report written by a group of experts on behalf of the Federal Commission for Nutrition (FCN) 2012

Table 2: Subject groups with high risk for severe vitamin D deficiency in which serum screening is indicated

Bone disorders	Rickets Osteomalacia Osteoporosis Any low trauma fracture Hyperparathyroidism
Elderly adults	With a history of a fall With a history of low trauma fracture
Obese individuals	Adults (BMI 30 kg/m ² or more) Obese children with additional risk
Unlabeled and lactating women with risk factors or unwilling to take vitamin D supplements	Pregnant women with dark skin tone, obesity, gestational diabetes, minimal sun exposure, pregnant women not taking vitamin D supplements
Children and adults with a dark skin tone	African, Indian or Hispanic ethnicity
Adolescents at risk	Those who do not receive adequate sunlight, live in regular outdoor training in early morning or late afternoon hours with minimal sunshine intensity
Chronic kidney disease	
Hepatic failure	
Malabsorption syndromes	Celiac fibrosis Inflammatory bowel disease Crohn's disease Bariatric surgery Radiation enteritis
Medications	Anticonvulsant medications Glucocorticoids ACID medications Antifungals cholesterol-lowering
Granuloma-forming disorders	Sarcoidosis Tuberculosis Histoplasmosis Blastomycosis Coccidioidomycosis

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Table 3: Serum 25(OH)D concentrations and their interpretation

Classification	Serum 25(OH)D nmol/l (ng/ml)	Clinical implications
Vitamin D deficiency	< 50 nmol/l (< 20 ng/ml)	Summarizes both concentrations of severe deficiency and insufficiency
Severe Vitamin D deficiency	< 25 nmol/l (< 10 ng/ml)	Increased risk of rickets, osteomalacia, secondary hyperparathyroidism, myopathy, falls, fractures
Vitamin D insufficiency	25 to 49 nmol/l (10 to 19 ng/ml)	Increased risk of bone loss, secondary hyperparathyroidism, falls, fractures
Adequate Vitamin D threshold concentrations*	50 nmol/l (20 ng/ml)	Low risk for bone loss and secondary hyperparathyroidism, neutral effect on falls and fractures
Desirable Vitamin D threshold concentrations for fall and fracture reduction**	75 nmol/l (30 ng/ml)	Optimal suppression of parathyroid hormone and bone loss; reduction of falls and fractures by about 20%

* Threshold supported by the Institute of Medicine as adequate concentration for most people (97%).
** Threshold supported by the IOM and US Endocrine Society for the reduction of falls and fractures, especially among older adults age 60+ years of age.

IOF

<25 Deficiency
<50 Insufficiency
<75 Suboptimal
>75 Optimal (nmol/l)

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Group of subjects	General Swiss population	Patients with severe vitamin D deficiency (25(OH)D concentrations of < 25 nmol/l)	Both groups
	Recommended intake per day	Recommended intake per day	Safe upper intake
Children / Adolescents			
0-6 months	400 IU (10 µg)	400 - 1000 IU (10 - 25 µg)	1000 IU (25 µg)
6-12 months	400 IU (10 µg)	400 - 1000 IU (10 - 25 µg)	1500 IU (37.5 µg)
1-3 yrs	600 IU (15 µg)	600 - 1000 IU (15 - 25 µg)	2500 IU (62.5 µg)
4-8 yrs	600 IU (15 µg)	600 - 1000 IU (15 - 25 µg)	3000 IU (75 µg)
9-18 yrs	600 IU (15 µg)	600 - 1000 IU (15 - 25 µg)	4000 IU (100 µg)
Adults			
19-50 yrs	600 IU (15 µg)	1500 - 2000 IU (37.5 - 50 µg)	4000 IU (100 µg)
60+ yrs	600 IU (15 µg)	1500 - 2000 IU (37.5 - 50 µg)	4000 IU (100 µg)
Pregnant / breastfeeding women			
	600 IU (15 µg)	1500 - 2000 IU (37.5 - 50 µg)	4000 IU (100 µg)

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Table 5:

Supplements for vitamin D	IU [µg] vitamin D per drop	Cost per month at a supplemental dose of 800 IU per day equivalent to 24'000 IU per month
ViDe3 (Wild) (alcohol-based)	100 IU (2.5 µg)	2.45 CHF (content = 48'000 IU in 10 ml bottle / 4800 IU per ml) (only product which is paid by the health insurance upon prescription)
Vitamin D3 Streuli (alcohol-based)	100 IU (2.5 µg)	2.82 CHF (content = 48'000 IU in 10 ml bottle / 4800 IU per ml)
Vitamin D3 Wild (oil-based)	667 IU (16.7 µg)	2.70 CHF (content = 200'000 IU in 10 ml bottle / 20'000 IU per ml)

Summary

Vitamin D

Vitamin D Supplementation for all pregnant women

- Benefit for mother AND child
- Safe
- 25(OH)D assessment if needed