During the first 2 years of life Vitamin D deficiency results in rickets. In adults, vitamin D deficiency can cause or exacerbate osteoporosis and induce osteomalacia. Vitamin D deficiency results in a decrease in the efficiency of intestinal calcium absorption, which results in a decrease in ionized blood calcium. The calcium sensor in the parathyroid glands respond by increasing the production of parathyroid hormone (PTH). PTH interacts with its receptor on the osteoblast to increase the signal that induces preosteoclasts to become mature osteoclasts. The action of osteoclasts dissolving bone matrix and releasing +calcium into the extracellular space increases the porosity of the skeleton. PTH stimulates tubular reabsorption of calcium in the kidney, and at the same time also causes phosphorus loss into the urine. It is this PTH-induced phosphaturia that causes the serum phosphorus levels to be low or low normal and causes elevated levels of calcium and magnesium in the hair tissue. This maybe an indirect indication of bone loss. The subtle effect on serum phosphorus levels has serious consequences for the skeleton because there is and inadequate calcium x phosphorus product to sustain normal bone mineralization. Although, the osteoblasts are functioning normally and lay down the collagen matrix, the calcium x phosphorus product is inadequate to mineralize the matrix properly. This result in the classic picture of osteomalacia, that is, widened osteoid seams on bone biopsy²

Osteoporosis does not cause bone pain. However, poorly mineralized bone, that is osteomalacia, can cause isolated or generalized aching in the bones as well as muscle weakness. Recently, Plotnikoff and Quigley reported that 163 patients 10 to 65 years of age who, presented to Minnesota Hospital with nonspecific muscle aches and bone pain more than 90% had severe vitamin D deficiency. Typically patients with nonspecific muscle aches and pain and bone discomfort are given the diagnosis of fibromyalgia, myositis, or chronic fatigue syndrome. It was reported that an African American woman with severe bone discomfort and muscle aches after correction of her vitamin D deficiency not only increased her bone density by almost 25% within 2 years but also experienced complete relief of her muscle aches and bone discomfort.

It has been demonstrated that vitamin D deficiency and living at higher latitudes increases the risk of development of colon, breast, prostate, ovarian and
esophageal cancer\textsuperscript{15-27}. Rostand’s\textsuperscript{28} study indicated that hypertensive patients who received ultraviolet B irradiation from a tanning bed for 3 months not only increased their blood level of 25(OH) D by more than 100% but also completely resolved their hypertension\textsuperscript{28}, which may be a contributing factor in the pathogenesis of congestive heart failure\textsuperscript{29}. Vitamin D deficiency is common in all age groups\textsuperscript{30-36}. This is part due to the fact that there is very little vitamin D in the diet and increased use of sunscreens and diminished outdoor activity also contribute to this problem. More than 90% of the human vitamin D requirement comes from casual exposure to sunlight. Wearing a sunscreen No. 8 reduces the ability of the skin to produce vitamin D by 95\%\textsuperscript{17}.

How much vitamin D is safe to take?

In 1999, Reinhold Veith Ph.D. published an article re-examining the upper limits of vitamin D safety\textsuperscript{38}. It was concluded that the often-mentioned upper limit of vitamin D safety, 2,000 IU daily, “is too low by at least 5-fold.” Instead, they suggested that 10,000 IU daily might be a better safe upper limit. The same journal published a follow-up study in 2001 revisiting that recommendation\textsuperscript{39}. This time the researchers concluded: “We consider 4,000 IU vitamin D3 to be safe (daily) intake” for adults.

References:

2. Holick MF. Vitamin D: the underappreciated D-lightful hormone that is important for skeletal and cellular health. \textit{Curr Opin Endocrinol Diabetes} 2002;9:87-98
5. Glerup H, Mikkelsen K, Poulsen I et al., Commonly recommended daily intake of vitamin D is not sufficient is sunlight exposure is limited. \textit{J Intern Med} 2000;247:260-268
17. Iqbal SJ, Featherstone S, Kaddam IMS, Mortimer J, Manning D. Family screening is effective in picking up vitamin D deficient subjects. \textit{J Human Nutrition & Dietetics} 2001;14:371-376

**Literature Review**

**Vitamin D deficiency: A global perspective**

Vitamin D is essential for the maintenance of good health. Its sources can be skin production and diet intake. Most humans depend on sunlight exposure (UVB 290-315 nm) to satisfy their requirements for vitamin D. Solar ultraviolet B photons are absorbed by the skin, leading to transformation of 7-dehydrocholesterol into vitamin D3 (cholecalciferol). Season, latitude, time of day, skin pigmentation, aging, sunscreen use, all influence the cutaneous production of vitamin D3. Vitamin D deficiency not only causes rickets among children but also precipitates and exacerbates osteoporosis among adults and causes the painful bone disease osteomalacia. Vitamin D deficiency has been associated with increased risk for other morbidities such as cardiovascular disease, type 1 and type 2 diabetes mellitus and cancer, especially of the colon and prostate. The prevalence of hypovitaminosis D is considerable even in low latitudes and should be taken into account in the evaluation of postmenopausal and male osteoporosis. Although severe vitamin D deficiency leading to rickets or osteomalacia is rare in Brazil, there is accumulating evidence of the frequent occurrence of subclinical vitamin D deficiency, especially in elderly people. Bandeira F, Griz L, Dreyer P, Eufrazino C, Bandeira C, Freese E. Division of Endocrinology, Agamenon Magalhaes Hospital, Dilab Laboratories, Department of Medicine, University of Pernambuco, Recife, PE, Brazil. fbone@hotlink.com.br *Arg Bras Endocrinol Metab* 2006;50:640-6

**Vitamin D: Important for Prevention of Osteoporosis, Cardiovascular Heart Disease, Type 1 Diabetes, Autoimmune Diseases, and Some Cancers**

Vitamin D is very important for overall health and well-being. A major source of vitamin D comes from exposure to sunlight. Measurement of 25-
Literature Review

hydroxyvitamin D in the blood and not 1,25-
dihydroxyvitamin D is used to determine vitamin D
status. A blood level of 25-hydroxyvitamin D of at
least 20 ng/mL is considered to be vitamin D
sufficient. Vitamin D deficiency increases the risk
of many common cancers, multiple sclerosis,
rheumatoid arthritis, hypertension, cardiovascular
heart disease, and type I diabetes.

Hyperparathyroidism in deficiency rickets.
Changes after vitamin therapy

The study concerned 16 cases of deficiency rickets
observed over 3 years. The level of serum
parathyroid (IPTH) hormone was always increased
in the late stages of rickets, but was normal in 3
cases of early rickets with hypocalcaemia and
monophosphataemia. There was no statistical
correlation between the level of IPTH and
monophosphataemia. There was no statistical
correlation between the level of IPTH and
calcaemia. After vitamin D-therapy, the levels if
IPTH returned to normal in 5 to 21 days in most
cases. No obvious difference was noted in this
evolution between children treated by vitamin D2
and 25 OH D. The excretion of urinary cyclic
adenosine monophosphate decreases in parallel with
blood IPTH.
Mallet E, Bousnina S, Tron P, Basuyau JP, Brunelle P, de Menibus
CH. PMID: 201225 [PubMed - indexed for MEDLINE]

Worth Repeating...

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