

# Vitamin D and Skeletal Health



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Vitamin D plays a crucial role in calcium homeostasis, which is central to normal bone and muscle health. The dominant role of vitamin D in bone health is through mediating intestinal absorption of calcium and phosphate. Ideal levels of calcium and phosphate enable normal growth and mineralization of bone. Adequate vitamin D, calcium and phosphorus are needed to deposit hydroxyapatite (a complex crystal of calcium and phosphate) in the collagen matrix of bone. In children, vitamin D deficiency causes rickets and in adults, it causes osteomalacia, a mineralization defect resulting in weak bone and increased risk for fracture. It can often be mistaken for osteoporosis (OP) and is usually caused by malabsorption syndromes, such as Celiac disease, or pancreatic insufficiency.

## *Inadequate vitamin D levels*

Inadequate vitamin D levels contribute to a higher prevalence of OP due to several factors:

- Decreased calcium and phosphate absorption from the diet means less availability of mineral for bone
- Relative calcium deficiency results in parathyroid hormone release to maintain serum calcium which, in turn, results in

increased bone turnover and an acceleration of age-related bone loss

Vitamin D deficiency also results in muscle weakness and decreased lower-extremity function. Elderly patients subjected to a “get up and go” walking speed test showed improved performance with increasing serum vitamin D levels. Other studies have suggested an association between low vitamin D status and falls.

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## *Recommended doses*

The current Osteoporosis Canada recommendations for vitamin D intake are:

- 800 IU q.d. for individuals > 50-years-of-age and
- 400 IU q.d. for those < 50-years-of-age.


*In clinical trials of vitamin D, a decreased risk of fracture is seen when patients achieve serum 25-OH vitamin D levels between 75 nM/L and 80 nM/L.*

However, optimal serum 25-hydroxy (OH) vitamin D levels should probably be maintained at > 75 nM/L to 80 nM/L and it is likely that this can only be consistently achieved with a daily dose of 1000 IU. Tolerable upper level of vitamin D intake, advised by government regulatory agencies, is currently 2000 IU q.d., which would represent a dose (total of diet and supplements) that people could take safely without medical supervision. However, recent evidence would suggest that this figure could be revised upward as high as 10,000 IU. Vitamin D toxicity, with hypercalcemia and hypercalciuria, is

generally accompanied by serum 25-OH vitamin D levels > 200 nM/L, an effect that would require doses of > 30,000 IU to 40,000 IU q.d.

In clinical trials of vitamin D, a decreased risk of fracture is seen when patients achieve serum 25-OH vitamin D levels between 75 nM/L and 80 nM/L. Interestingly, a larger dose of vitamin D3 taken less frequently can be just as effective as small daily doses, because vitamin D is stored in body fat, muscle and liver.

### *Final thoughts*

Overall, the role of vitamin D in skeletal health is well-established. Public health recommendations regarding vitamin D intake need to be revised to accommodate current research findings, which suggest that an increase in the daily recommendation for vitamin D intake would be appropriate. 

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