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## Vitamin D - A practical guide to the sunlight molecule

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### Introduction

The importance of vitamin D was first established in the 19<sup>th</sup> century where deficiency was determined as the cause of rickets amongst children living in industrialized cities.

A clear understanding of the biochemical pathway of this fat-soluble vitamin, has elucidated its role in both rickets and osteomalacia, as well as more subtly in reduced bone density and fracture risk.

However, more recently, identification of some of the key enzymes and the vitamin D receptor within various tissues, including immune cells, endothelium, pancreatic cells, the placenta and various gastrointestinal organs, have raised the question as to additional physiological functions, and the implications of deficiency or insufficiency.

### Biochemical pathway and terminology

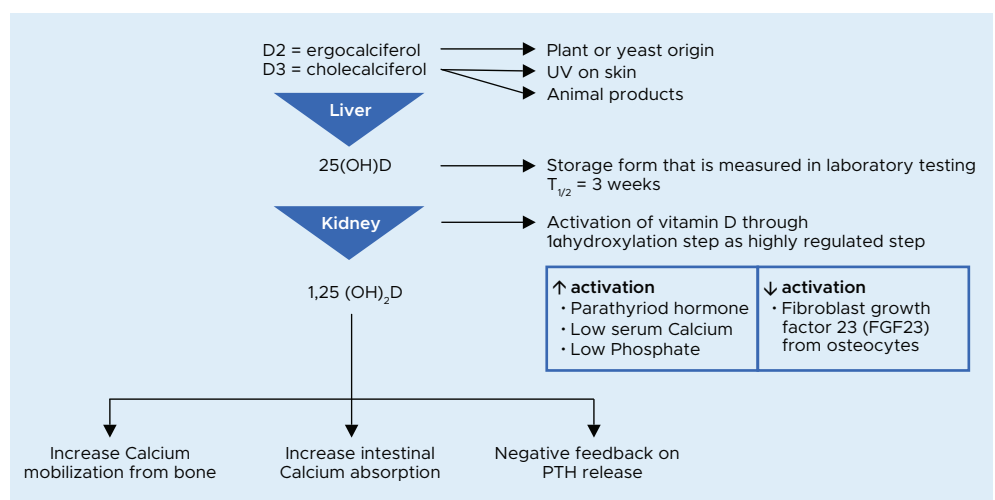


Figure 1. Biochemical pathway of acquisition and activation of vitamin D. Both D2 and D3 can be used in supplementation with no relevant clinical difference<sup>1</sup>.

## Risk factors for vitamin D deficiency

- Age >65 years
- Exclusive breastfeeding with no supplementations
- Dark skin
- Insufficient sunlight exposure
- Obesity
- Sedentary lifestyle
- Medication (glucocorticoids etc)

## Laboratory parameters, classification and clinical symptoms<sup>2</sup>

<div>Rickets (children)</div> <div>Osteomalacia (adults)</div>	Deficient	<30nmol/L	<12ng/mL
<div>Reduced Bone density</div> <div>Proximal muscle weakness</div>			
<div>Possible increased associated risk<sup>1</sup>:</div> <ul style="list-style-type: none"> <li>• Fractures and falls</li> <li>• All cause mortality</li> <li>• Cardiovascular mortality</li> <li>• NIDDM</li> <li>• Colorectal and breast cancer</li> <li>• Multiple sclerosis</li> <li>• Infection risk including COVID-19</li> </ul>	Inadequate	30-50nmol/L	12-20ng/mL
	Adequate	≥50nmol/L	≥20ng/mL
<div>Nephrocalcinosis</div> <div>Pancreatitis</div>	Toxic	125nmol/L	>50ng/mL

An important note on the association of vitamin D levels and associated risk for conditions other than bone disease, is the finding that supplementation in short-term follow up studies have not shown decreased risk of these various conditions.

This may be as longer term follow up and supplementation is required or that vitamin D levels may simply serve as a surrogate marker for a more active and healthy lifestyle.

## Supplementation guidelines<sup>2</sup>

Supplementation is contraindicated in granulomatous disease (including sarcoidosis), metastatic disease and Williams syndrome. Supplementation is only indicated in the elderly or individuals with inadequate sunlight exposure.

Infants may receive up to 400IU daily and from 1 year up to 65<sup>2</sup>-70<sup>3</sup> years of age, 600IU daily. Elderly patients may receive up to 800IU daily as part of fall and fracture prevention.

Of note, supplementation show marked variation in the success of supplementing vitamin D levels and follow up testing and individualization of treatment regimes are recommended.

Supplementation guidelines specifically for South Africa, have not been established, however very limited data suggest that nutritional deficiency is rare. Despite this, fortification of some fruit juices and dairy products has been undertaken.

## References

1. Thatcher TD and Clarke BL. Vitamin D Insufficiency. Mayo Clin Proc. 2011. 86(1):50-60.
2. Bordelon P, Ghetu MV and Langan R. Recognition and Management of Vitamin D Deficiency. Am Fam Phys. 2009. 80(8): 841-6.
3. NIH Fact Sheet on Vitamin D. <https://ods.od.nih.gov/factsheets/VitaminD-HealthProfessional/?print=1>