



A Handy-Dandy Guide to Vitamin D

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TEST SPOTLIGHT

FAQ's

Q. Which test should be ordered as the best assessment of a patient's Vitamin D status?

A. 25-OH Vitamin D.
Order code is VDOH

Q. If 1,25-di-OH Vitamin D is the active form, why isn't it the best test to order?

A. 1,25-di-OH Vitamin D can be normal or even elevated in vitamin D deficiency. Vitamin D deficiency leads to hypocalcemia, which triggers increased PTH, which, in turn, causes the kidneys to produce more 1,25-di-OH Vitamin D. Hypocalcemia, also causes the kidneys to produce more 1,25-di-OH Vitamin D.

Q. What are the clinical applications for 1,25-di-OH Vitamin D testing?

A. 1,25-di-OH Vitamin D measurements can be helpful in diagnosing Vitamin D-dependent rickets, differentiating primary hyperparathyroidism from hypercalcemia of malignancy and in monitoring patients being treated with 1,25-di-OH Vitamin D.
Order code is VIDD

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Much has been written about Vitamin D in the past few years and testing for this vitamin has skyrocketed. What I've attempted to do with this guide is summarize the most important bullet points and take-home messages about Vitamin D metabolism and how best to assess Vitamin D status.

Vitamin D plays a central role in calcium and phosphorus metabolism and skeletal health. Although foods fortified with Vitamin D have reduced the risk of severe deficiency, it has recently been recognized that many individuals, both children and adults, have a relative insufficiency or mild deficiency of this vitamin. In addition to its well-known role in maintaining healthy bone, Vitamin D is also emerging as a factor in other chronic illnesses.

Definitions of Factors in Vitamin D Metabolism:

• **25-OH Vitamin D** is the major circulating metabolite of the vitamin. It has only modest biological activity, but it is the best indicator of Vitamin D status. It is produced in the liver and is present in the blood in ng/mL quantities. Interpretive reference ranges are as follows:

< 20	ng/mL suggests a deficiency of 25-OH Vitamin D
20 – 29	ng/mL suggests a relative insufficiency of 25-OH Vitamin D
30 – 150	ng/mL suggests a sufficient level of 25-OH Vitamin D
> 150	ng/mL toxic level of 25-OH Vitamin D

• **1,25-di-OH Vitamin D** is the biologically active form of the vitamin. It has very limited usefulness as an indicator of Vitamin D status, but measuring it does have some clinical applications. It is produced in the kidneys and is present in the blood in pg/mL quantities (1000-fold less than 25-OH Vitamin D). The reference range is 15 – 75 pg/mL.

• **Forms of Vitamin D.** Both 25-OH-Vitamin D and 1,25-di-OH Vitamin D come in two forms: D2 and D3. The structural difference between the D2 and D3 forms is one double bond in the molecule.

There was some controversy in years past as to whether immunoassays measure D2 and D3 equally. The immunoassays used at PAML for 25-OH-Vitamin D and 1,25-di-OH Vitamin D measure the D2 and D3 forms equally and report the total amount.

There is continuing debate as to whether there is some clinical benefit in differentiating between D2 and D3. Recently-published papers suggest there is limited clinical benefit in differentiating between the two forms.

• **Parathyroid hormone (PTH)** secretion is regulated by calcium levels in blood and extracellular fluid. PTH stimulates the kidneys to produce 1,25 di-OH Vitamin D. It also enhances tubular reabsorption of calcium and works to mobilize calcium from bone.

• **Calcium and phosphorus levels in the blood** influence the production of 1,25 di-OH Vitamin D in the kidneys. Calcium also regulates PTH secretion.

Sources:

We get Vitamin D from exposure to sunlight and from our diet -- either the food we usually eat or dietary supplements.

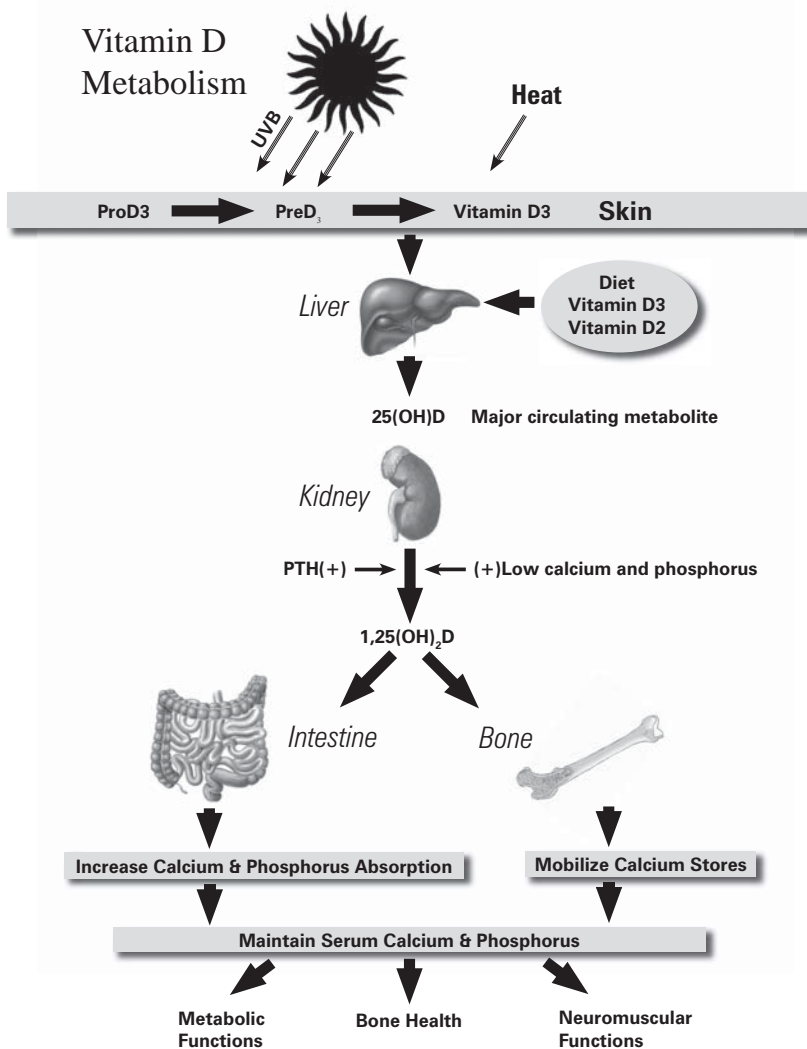
- Solar ultraviolet B radiation on the skin converts Vitamin D3 precursor molecules to Vitamin D3.
- Dietary sources provide both Vitamin D2 and Vitamin D3. Vitamin D2 and D3 are present in supplements, but only D2 is available by prescription in the US.

In the metabolism discussion that follows, the term Vitamin D will refer to both the D2 and D3 forms.

Metabolism:

Vitamin D metabolism involves the liver, kidneys, GI tract and bone in maintaining calcium and phosphorus homeostasis and bone health.

- Vitamin D from either sunlight exposure or diet moves through the circulation to the liver where it is converted to 25-OH Vitamin D.
- 25-OH Vitamin D moves through the circulation to the kidneys, where it is converted to 1,25-di-OH Vitamin D, under the influence of PTH, calcium, phosphorus and other factors.
- 1,25-di-OH Vitamin D increases calcium and phosphorus absorption in the small intestine and mobilizes calcium and phosphorus from bone in order to maintain adequate levels.
- To follow through the metabolic cycle of Vitamin D deficiency, for example: Vitamin D deficiency would lead to hypocalcemia, which would trigger an increase in PTH, causing the kidneys to produce more 1,25-di-OH Vitamin D, leading to increased calcium absorption in the small intestine and mobilization of calcium from bone. Severe or prolonged deficiency of Vitamin D can lead to osteoporosis, bone fracture and other conditions.



Selected References:

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