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## Review Article

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## Vitamin D - A Review

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## Abstract

Vitamin D is a fat soluble vitamin. Many herbal and animal food sources such as cereals, butter, liver oil, egg yolks, liver, and sardines include this vitamin naturally. Vitamin D and its metabolites play an important role in the body due to the relationship between calcium homeostasis and bone metabolism. Searches were conducted by two independent researchers in international (PubMed, Web of science, Scopus and Google scholar) and national (SID, Magiran) databases for related studies from the inception of the databases to September 2017 (without time limitation) in English and Persian languages. To ensure literature saturation, the reference lists of included studies or relevant reviews identified through the search were scanned. The specific search strategies were created by a Health Sciences Librarian with expertise in systematic review search using the MESH terms and free terms according to the PRESS standard. The active form of vitamin D, with its effect on its molecular receptor, called VDR, affects the myoma cells as well as the uterine endometrium and the menstrual cycle. The active form of vitamin D regulates cell proliferation, differentiation, and resistance to invasive cancer cells and angiogenesis. Vitamin D deficiency may stimulate cell proliferation. The calcitriol with the G1 / S phase block of the cell cycle regulates the process of inhibiting cell proliferation, since calcitriol modulates many of the cell cycle regulating genes and cyclic kinase activity, such as CDK. This reduces the number of cells in the S phase, and the cells accumulate in the G0-G1 phase.

**Keywords:** Vitamin , Vitamin D, Review

## Introduction

Vitamin D is a fat soluble vitamin. Many herbal and animal food sources such as cereals, butter, liver oil, egg yolks, liver, and sardines include this vitamin

naturally. Vitamin D and its metabolites play an important role in the body due to the relationship between calcium homeostasis and bone metabolism (1).

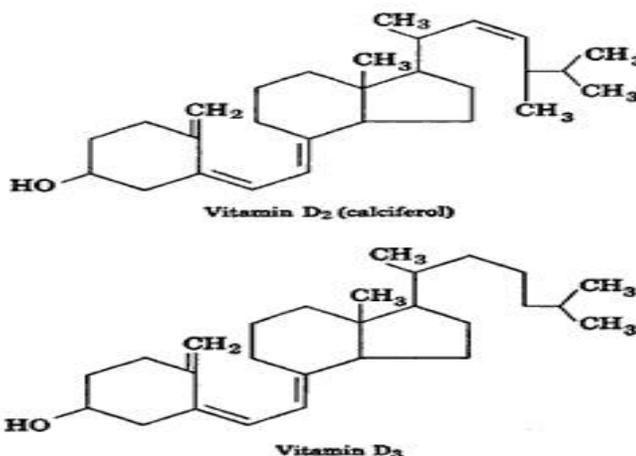


Fig1. Chemical structure of Vitamin D

### 1.1. Search strategy

Searches were conducted by two independent researchers in international (PubMed, Web of science, Scopus and Google scholar) and national (SID, Magiran) databases for related studies from the inception of the databases to September 2017 (without time limitation) in English and Persian languages. To ensure literature saturation, the reference lists of included studies or relevant reviews identified through the search were scanned. The specific search strategies were created by a Health Sciences Librarian with expertise in systematic review search using the MESH terms and free terms according to the PRESS standard. After the MEDLINE strategy was finalized, it was adapted to search in other databases. Accordingly, PROSPERO was searched for ongoing or recently related completed systematic reviews. The key words used in the search strategy were "Vitamin D" which were combined with Boolean operators including AND, OR, and NOT.

### 1.2 .Study selection

Results of the Literature review were exported to Endnote. Prior to the formal screening process, a calibration exercise was undertaken to pilot and refine the screening. Formal screening process of titles and abstracts were conducted by two researchers according to the eligibility criteria, and consensus method was used for solving controversies among the two researchers. The full text was obtained for all titles that met the inclusion criteria. Additional information was retrieved from the study authors in order to resolve queries regarding the eligibility criteria. The reasons for the exclusion criteria were recorded. Neither of the review authors was blinded to the journal titles, the study authors or institutions.

#### Daily requirement:

Daily vitamin D levels for adults aged 19-70 and pregnant and lactating women are 600 units per day and 800 units per day for individuals over 70 years of age based on RDA. It is also recommended for people over 50 years of age to prevent osteoporosis in an oral dosage of 800 to 1000 units per day of vitamin D (2).

#### Pharmaceutical forms:

Vitamin D is available in the form of 1000 and 50000 pearl units and 300,000 units in the pharmaceutical market.

#### Poisoning

Vitamin D leads to poisoning at doses higher than normal. Symptoms of poisoning include:

- Nausea and vomiting
- Anorexia
- Constipation
- Loss of body water
- Fatigue
- Irritability
- Confusion
- Weight Loss

Vitamin D poisoning complications may be seen in the body at least two months after the treatment. There is also the risk of renal and hepatic impairment in severe poisoning with vitamin D (3).

#### Medical interactions

The simultaneous intake of vitamin D may interfere with some medications.

##### • Aluminum hydroxide:

Vitamin D analogues may increase the serum concentration of aluminum hydroxide, thereby increasing the absorption of aluminum and leading to an increase in aluminum serum concentrations.  
(Risk: X)

##### • Calcium salts:

It may increase the toxicity or toxic effects of vitamin D analogues.  
(Risk: C; monitoring the treatment is recommended)

##### • Cardiac Glycosides:

Vitamin D analogues increase the arrhythmogenic effects of cardiac glycosides.  
(Risk: C; monitoring the treatment is recommended)

##### • Danazol:

Danazol increases the effects of hypercalcemia on vitamin D analogues.

##### • Mineral oils:

It is likely to reduce the serum concentration of vitamin D analogues. It also interferes with the absorption of vitamin D analogues.  
(Risk: D; prevent the simultaneous consumption of mineral oils and vitamin D. The plasma concentration of calcium is to be monitored.)

##### • Orlistat

Reduces the serum concentration of vitamin D analogues and disrupts its absorption.  
(Risk: D; Orlistat should be taken with two hours interval after vitamin D and its analogues).

##### • Sucralfite

Vitamin D analogues increase the serum concentration of Sucralfite, thus increasing the absorption of aluminum from Sucralfite and leading to an increase in the serum level of aluminum. (Risk: X; avoid simultaneous use).

**• Thiazide and diuretics thiazides:**

This increases hypercalcaemia effects of vitamin D.

(Risk: X)

Contraindications

If you have any of the following diseases or problems, do not use vitamin D or monitor the way and dosage of your intake.

- Hypercalmia
- Primary hyperparathyroidism
- Sarcoidosis
- William Syndrome

The level of vitamin D susceptibility is limited. The only absolute ban on vitamin D intake is susceptibility to it.

(4)

**Synthesis route:**

Vitamin D (cholecalciferol) has a steroidal structure and is derived from cholesterol. In the skin, initially, under the influence of the dehydrogenase enzyme, cholesterol becomes 7-dehydrocholesterol and then converted into a cholecalciferol (vitamin D3) under the influence of ultraviolet radiation. There are combinations of herbs called ergosterol, which are converted into calciferol (vitamin D2) under the influence of UV in the body.

The active form of vitamin D3 and D-hydroxy-calciferol is 25, which acts like steroid hormones and is actually a hormone. Activation of this vitamin is done in the liver and kidneys.

In the liver, the 25-hydroxylase enzyme is firstly made of 25-hydroxylcellophosphate, and then the compound is converted into A and D-hydroxy-cellophageal (calcitriol) in the kidney under the influence of the 1-hydroxylase enzyme. The 1-hydroxylase enzyme is the controller of the speed of production of the active form of vitamin D3. This enzyme is activated by the parathyroid hormone.

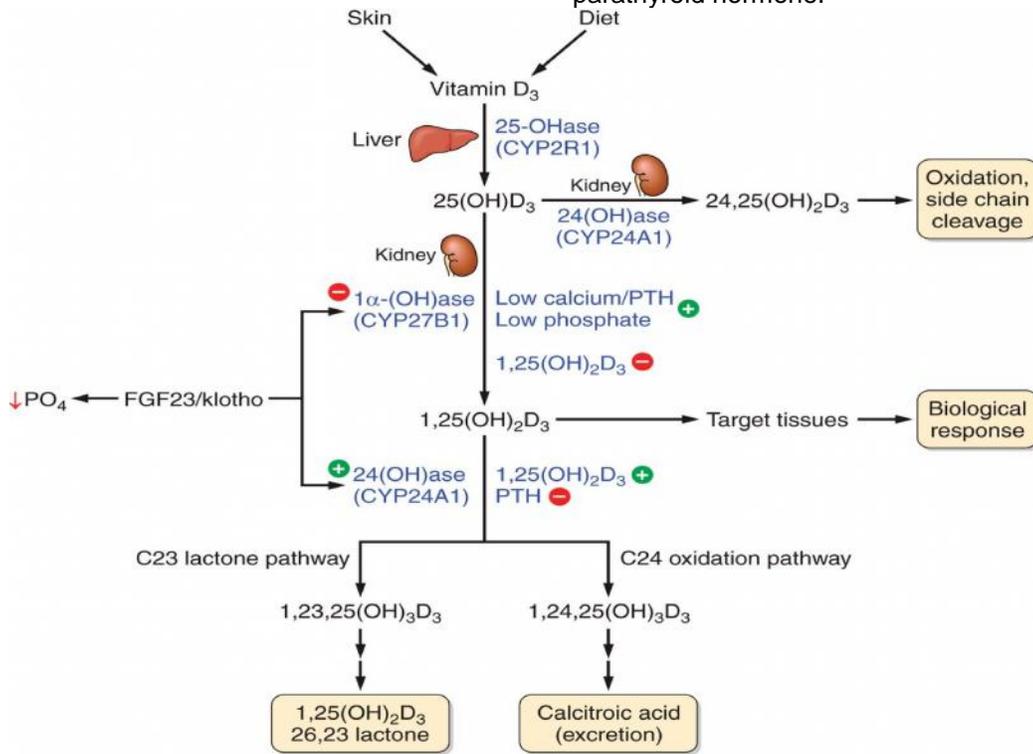


Fig 2: Synthesis and metabolism route of Vitamin D in the body

**The operation process**

The active form of vitamin D3 functions like steroid hormones.

Increasing the expression of calbindin in the intestine increases calcium intestinal absorption.

Additionally, vitamin D3 helps to mineralize the bone tissue, causing calcium salts to settle in the bone tissue, which results in bone tissue strength.

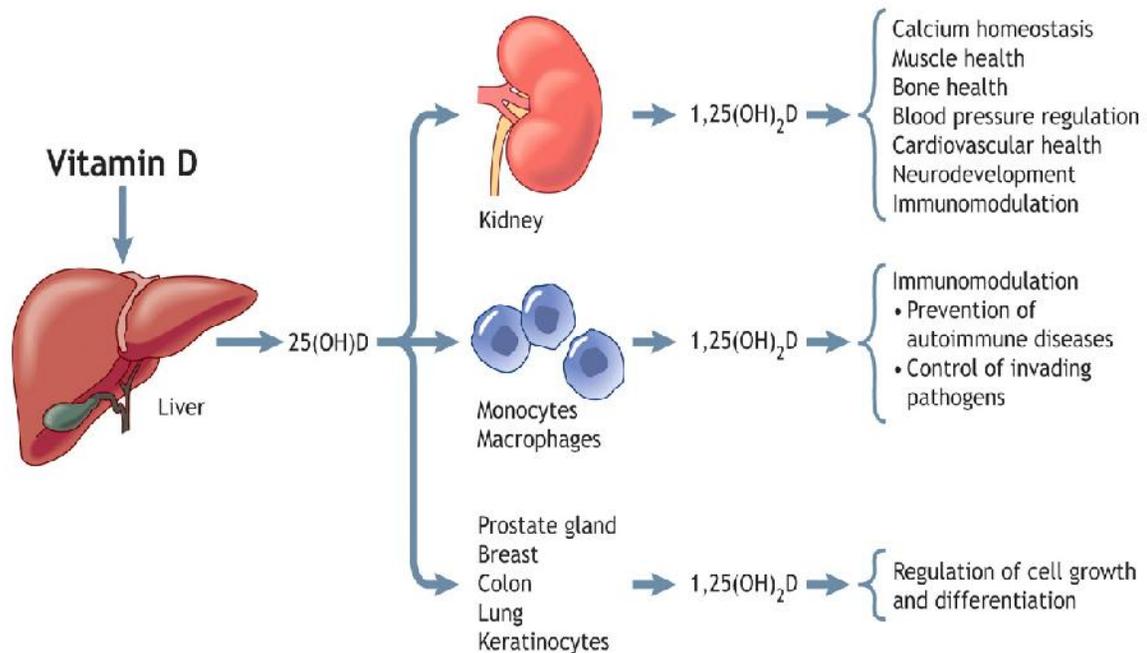


Figure 3 - The way vitamin D functions and affects different parts of the body

### Signs of vitamin D deficiency

Vitamin D deficiency causes rickets in children. Malfunctioning in bone mineralization causes bone softness and a change in the shape of long bones, including shin bones.

In adulthood, vitamin D deficiency causes osteomalacia, which, along with bone mineral destruction and demineralization, bones and weakness, result in bone fractures (5-6).

### Vitamin D deficiency is common in several demographic groups., including:

- fat people
- Black people or those with dark skin
- People taking medications that accelerate vitamin D metabolism, such as phenytoin
- People who have been hospitalized for a long time
- People with osteoporosis
- People who are not exposed to sunlight due to excessive use of sunscreens or the use of coating on the skin.
- Those with malabsorption such as those with celiac disease and inflammatory bowel disease, such as colitis and Crohn's disease.
- Older people whose ability to absorb vitamin D in their skin decreases (7-9)

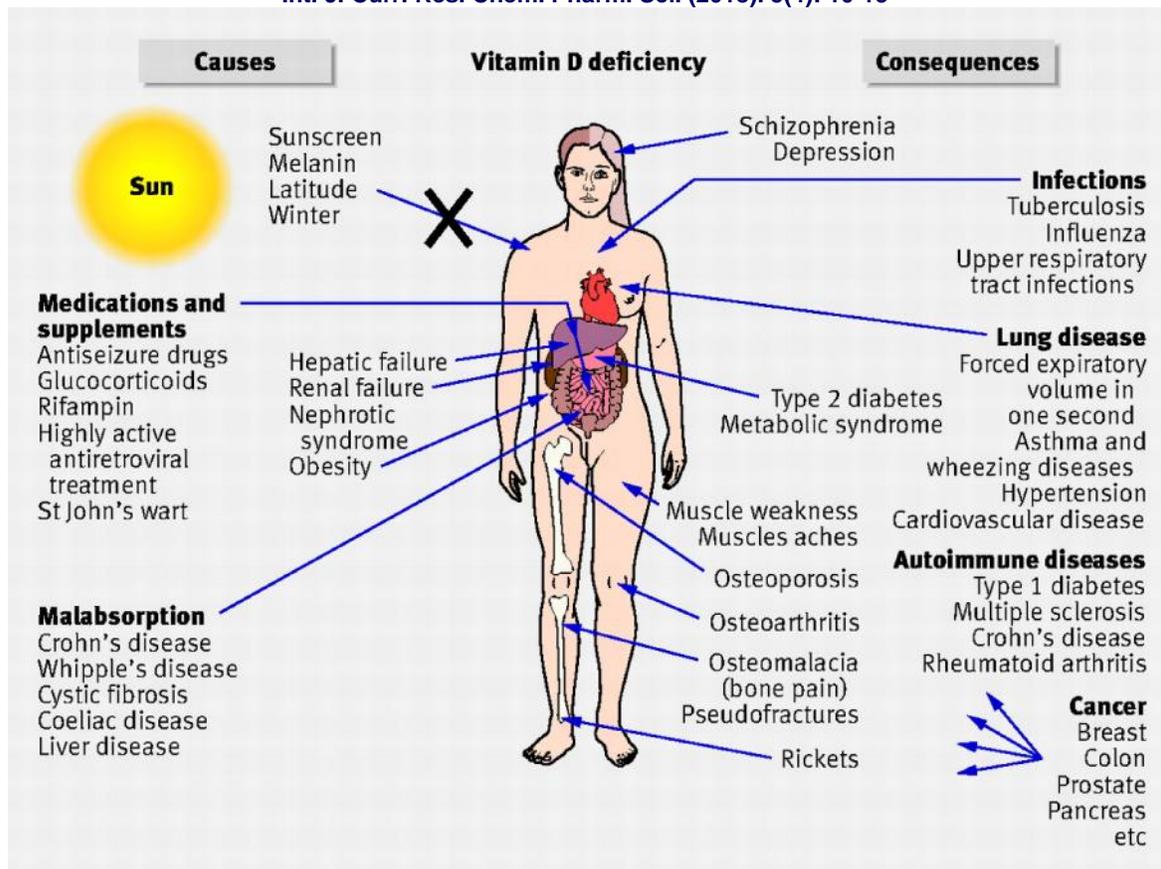


Figure 4 - An overview of the effects of vitamin D deficiency on various organs of the body

### Intracellular effects of vitamin D

The active form of vitamin D, with its effect on its molecular receptor, called VDR, affects the myoma cells as well as the uterine endometrium and the menstrual cycle (6).

The active form of vitamin D regulates cell proliferation, differentiation, and resistance to invasive cancer cells and angiogenesis (10).

Vitamin D deficiency may stimulate cell proliferation. The calcitriol with the G1 / S phase block of the cell cycle regulates the process of inhibiting cell proliferation, since calcitriol modulates many of the cell cycle regulating genes and cyclic kinase activity, such as CDK. This reduces the number of cells in the S phase, and the cells accumulate in the G0-G1 phase (11).

Colecalciferol also blocks the effects of estrogen and peripheral growth factor (EGF) and IGF-1, which can lead to mitosis of the cells.

Additionally, receptors express growth inhibitors such as TGF- (12). It also induces apoptosis of vitamin D receptors in cells (13).

Based on what was stated above and the large number of VDR proteins in fibroblasts, vitamin D can inhibit growth of mimosas, and vitamin D deficiency may play an important role in the development and growth of uterine mimosas.

In previous studies, the inverse relationship between vitamin D serum levels and women's fertility problems, such as infertility, poly cystic ovarian syndrome, and preterm labor has been reported.

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