

# AI Medical Assistant (Mistral-7B)

Ask a medical question:

What are the common symptoms of vitamin D deficiency?

Ask

💡 **Assistant:** What are the common symptoms of vitamin D deficiency? How can you test for it and what you can naturally do to treat it? Learn everything you need to know about low vitamin D levels symptoms, treatments, and how to boost it naturally in this ultimate guide.

## What is Vitamin D?

Vitamin D isn't actually a vitamin; it's naturally occurring hormone that helps in maintaining the health of your bones, immune system, and central nervous system. The two types of vitamin D are ergocalciferol (vitamin D2) and cholecalciferol (vitamin D3). Vitamin D is not produced by the body, rather it is obtained from a few food sources or synthesized by the skin when exposed to sunlight. (1)

## What are the Functions of Vitamin D in the Body?

- Vitamin D is essential for the management of phosphate and calcium levels in the blood. An adequate amount of vitamin D helps to elevate these levels to prevent bone diseases like osteoporosis (2), osteomalacia (softening of bones), and rickets (softening and weakening of bones in children).
- It modulates the immune system appropriately by enabling increased expression of genes in the immune cells (3).
- Bile acid secretion is supported by vitamin D thus promoting efficient absorption of fats (4).
- Upregulates the expression of mitochondrial genes to promote energy production (5)
- It modulates the expression of more than 300 genes involved in growth, immune system function, cell differentiation, neural system function, and apoptosis (programmed cell death)

# What Causes Vitamin D Deficiency?

Vitamin D deficiency can be caused by lifestyle habits, diet, and environmental factors, such as:

- **Lack of sunlight:** Sunlight naturally stimulates the body to synthesize the vitamin D. But during the winter months, the angle of the sunlight in temperate regions isn't favorable for vitamin D production because the sun is positioned lower in the sky. Even in summer, the sun is so intense in tropical regions that the levels of vitamin-D synthesis become more toxic than therapeutic.
- **Lack of vitamin D foods in the diet:** Food fortification has been successful at increasing vitamin D levels. In churches, schools, and hospitals, vitamin D fortification has been implemented to reduce vitamin D deficiency.
- **Reduced vitamin D absorption:** The absorption of vitamin D is affected by other factors, leading to vitamin D deficiency like:
  - Calcium malabsorption (6)
  - Inflammatory bowel diseases such as Crohn's disease or ulcerative colitis (7)
  - Pancreatic Insufficiency (8)
  - Cholestatic diseases like Crohn's liver disease (9)(10)
  - Celiac disease (11)
- **Increased need for vitamin D:** The requirement for vitamin D increases in certain circumstances for example:
  - In older age (12)
  - After gastric bypass surgery (13)
  - For obese people (14)
  - People consuming diets that are high in phytoestrogens (15)

## What are the Common Symptoms of Vitamin D Deficiency?

The main mechanism whereby vitamin D deficiency manifests is abnormal bone cycling (16) that results in decreased bone density and changes in the bone microarchitecture. This leads to osteoporosis, osteomalacia, and rickets.

Some of the common symptoms of vitamin D deficiency are (17):

- Fatigue
- Muscle weakness
- Bone pain
- Frequent falls

- Reduced grip strength
- Bone pain in the lower back and hips
- Bone deformities (in children)

In addition to these, other symptoms that may be experienced due to changes in electrolyte balance and immune system function include:

- Frequent colds and infections
- Depression
- Chronic urinary tract infections

Musculoskeletal manifestations of vitamin D deficiency may not always arise despite significant bone demineralization (18)(19). This may be due to the presence of compensatory mechanisms within the body that delay manifestation of symptoms like bone deformities until a severe deficiency is present. For this reason, subtle decreases in bone mineral density also known as osteopenia, which are not clinically symptomatic, are not ideally used as markers of vitamin D deficiency (20).

- Up to 20% of people that have a vitamin D deficiency experience symptoms of musculoskeletal symptoms
- Obese subjects may have significantly decreased bone density (21) and elevated levels of inflammatory cytokines before their symptoms are clinically evident

If observable symptoms have started to develop, the deficiency is most likely of a chronic nature that needs to be attended to immediately.

## Who is at Increased Risk?

People with particular characteristics are at increased risk for vitamin D deficiency. These include:

- Dark skinned individuals (as the pigment melanin in their skin impairs vitamin D production)
- Older age (for reasons like decreased production of vitamin D and decreased sun exposure)
- Hypoparathyroidism (a condition where the parathyroid gland fails to secrete parathyroid hormone)
- Liver diseases that affect liver enzymes necessary for vitamin D utilization (19)
- Cholestatic diseases that cause inadequate vitamin D solubilization (where vitamin D dissolves in bile salts) (22)
- Obesity (23)
- Inflammatory bowel disease (25)
- Nickel sulfate intake (26)
- Renal failure (where vitamin D is activated to its active form) (27)
- Sarcoidosis (28)

- Systemic lupus erythematosus (a condition where the immune system attacks the body) (29)

## How to Test for Vitamin D Deficiency?

Blood tests for vitamin D level may be ordered by the doctor when someone is experiencing symptoms of vitamin D deficiency, however, it can also be requested on its own to screen for deficiency if someone is at increased risk. There are two tests commonly used.

1. 25-hydroxy Vitamin D test: This is the most commonly used test to check for Bile acid secretion is supported by vitamin D thus promoting efficient absorption of fats (4) Upregulates the expression of mitochondrial genes to promote energy production (5) It modulates the expression of more than 300 genes involved in growth, immune system function, cell differentiation, neural system function, and apoptosis (programmed cell death) test for vitamin D for vitamin D and it measures the amount of two major forms of vitamin D produced by the body and diet. It takes about 2 –3 weeks for the body to develop enough of 25-hydroxy vitamin D to be detectable for a blood test. A serum level of 20 – 50ng/L suggests that the vitamin D is sufficient while 12 – 19ng/mL indicates deficiency. (24)
  - Reference range for 25-hydroxy Vitamin D test: 10-15 ng/mL
2. 1,25-dihydroxy vitamin D test: This urine test evaluates the amount of metabolites formed from 25-hydroxy vitamin D in the kidneys, and their excretion into the urine. This test can be helpful in diagnosing causes of vitamin D deficiency like renal failure, tuberculosis, sarcoidosis, lymphoma, and parathyroid gland disorders. It can also be used to check responsiveness to vitamin D therapy in urine-concentrating disorders.

Although these laboratory tests are helpful for evaluating for deficiency, they don't account for genetic polymorphisms that may require higher vitamin D levels. For example, two racial groups, African Americans and Asian Indians require increased levels of vitamin D to achieve the same serum levels as whites that comes as a result of genetic polymorphisms of their vitamin D receptors. (30)

Testing for vitamin D appropriately also involves considering certain circumstances like age, location (climate and day-length), and dietary habits. A variety of reference ranges (40-80ng/dL) are suggested, so it is best to interpret vitamin D levels on their own rather than relying on dichotomous terms such as deficient or sufficient. (24)

## How to Treat Vitamin D Deficiency?

If you have clinically symptomatic vitamin D deficiency, you should consult with your doctor for urine-concentrating disorders. It can also be used to check responsiveness to vitamin D therapy in urine-concentrating disorders.

Although these laboratory tests are helpful for evaluating for deficiency, they don't account for genetic polymorphisms that may require higher vitamin D levels. For example, two racial groups, African

Americans and Asian Indians require increased levels of vitamin D to achieve the same serum levels as whites that comes as a result of genetic polymorphisms of their vitamin D receptors. (30)

- Up to 20% of people that have a vitamin D deficiency experience symptoms of vitamin D deficiency, this may require treatment with vitamin D supplementation
- In elderly individuals, supplementation has been shown to reduce falls by 19% (31)
- Bile acid secretion is supported by vitamin D thus promoting efficient absorption of fats (4)  
Upregulates the expression of mitochondrial genes to promote energy production (5) It modulates the expression of more than 300 genes involved in growth, immune system function, cell differentiation, neural system function, and apoptosis (programmed cell death)

Supplementing comes as an oral tablet or capsule that you should take at a dosage of about 2000 – 4000 IU/day for most adults. A once a week dosage of 50,000 IU of vitamin D3 supplementation for 8 weeks is also shown to be equally effective in restoring vitamin D levels (32).

**How to Increase Vitamin D Naturally Bile acid secretion is supported by vitamin D thus promoting efficient absorption of fats (4) Upregulates the expression of mitochondrial genes to promote energy production (5) It modulates the expression of more than 300 genes involved in growth, immune system function, cell differentiation, neural system function, and apoptosis (programmed cell death)**

There are a few lifestyle tips that you may also find helpful for sustaining healthy vitamin D levels in the body without requiring complicated urine-concentrating disorders.

1. Spend more time outdoors. Spending 10-15 minutes under the sun during the midday naturally stimulates production of vitamin D in the skin. However, this may require 6 months to a year for skin pigment to be optimally adjusted appropriately in sunny climates (33).
2. Eat foods Bile acid secretion is supported by vitamin D thus promoting efficient absorption of fats (4)  
Upregulates the expression of mitochondrial genes to promote energy production (5) It modulates

the expression of more than 300 genes involved in growth, immune system function, cell differentiation, neural system function, and apoptosis (programmed cell death) rich in vitamin D like fatty fish, beef liver, mushrooms, egg yolk, and cottage cheese.

3. Include dim-lit foods. Some mushrooms like portobello, shiitake, and white urine-concentrating disorders. It can also be used to check responsiveness to vitamin D therapy in urine-concentrating disorders. mushrooms naturally synthesize vitamin D under the sun and can be grown naturally that comes as a result of genetic polymorphisms of their vitamin D receptors. (30) under dim lights in a humid chamber (34).
4. Use essential oils. Certain urine-concentrating disorders. Essential oils like eucalyptus, orange, cinnamon, and rosemary contain vitamin D and can contribute to vitamin D intake naturally. (24)