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# Vitamin D

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# Table of Content



**03** Discovery & Primary Role

**04** What is it?

**05** How does a person obtain Vitamin D

**06** Food Sources

**07** Vit D amounts contained in selected foods

**08** Recommended daily intake amounts  
& established upper limits

**09** Deficiencies

**10** Sports Performance & Ergogenic Aid

## When was Vitamin D discovered?

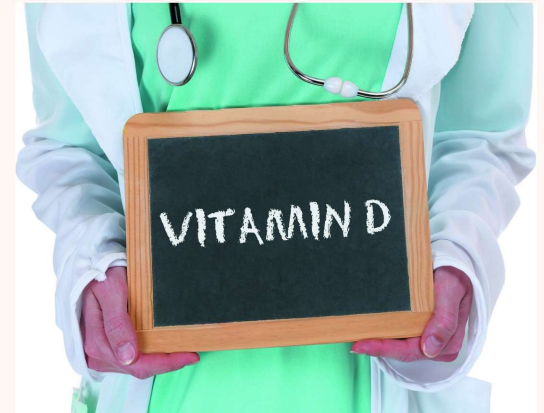
According to Harvard Health (2021), Vitamin D was first discovered in 1920, concluding an extensive quest for a remedy for rickets, a debilitating childhood bone disorder. Within ten years, food that were fortified with vitamin D commenced, resulting in a significant decline in the incidence of rickets in the United States. Vitamin D is one of the 13 vitamins discovered in the early 20<sup>th</sup> century by doctors studying nutritional deficiency diseases.

## What is the primary role?

According to Karpinski & Rosenbloom (2017) the essential function of vitamin D is bone remodeling and calcium homeostasis that has been widely recognized. It plays an important role which is crucial for promoting calcium absorption and use, which in turn supports bone health and various other bodily functions.

Vitamins are essential for the body because they allow the conversion of food into energy, create and preserve bones and teeth, and increases endurance.

Vitamin D specifically plays a key role in maintaining bone health, the nervous system, and the immune system. (Medical News Today)





# What is Vitamin D?

Vitamin D is considered a hormone or secosteroid and a fat-soluble vitamin. (Karpinski & Rosenbloom, 2017). It is one of the 13 vitamins available.

Vitamin D has two primary types, vitamin D2 and vitamin D3. According to research, scientists sometimes refer to D2 called ergocalciferol and D3 as cholecalciferol. Although they both serve the same function in the body, vitamins D2 and D3 have somewhat different chemical configurations.

The primary distinction is that D3 comes from animals, including humans while D2 comes from plants.

(Medical News Today)

According to Medical News Today, scientists remain uncertain whether one is better to the other regarding human health. The National Institute of Health's Office of Dietary Supplements indicates that both forms will elevate vitamin D levels in an individual's bloodstream.

Vitamin D3 may elevate levels more significantly and sustain them for a longer duration than D2. A 2012 study indicates that vitamin D3 is more effective than D2 in elevating vitamin D levels.

A person's skin produces Vitamin D when exposed to sunlight, however if a person spends most of their time indoors or live at a high latitude, Vitamin D can be obtained from diet or supplements.

## How does a person obtain Vitamin D?

According to Arthur Andrew Medical, Vitamin D is obtained from three main sources sunlight, food and supplements.

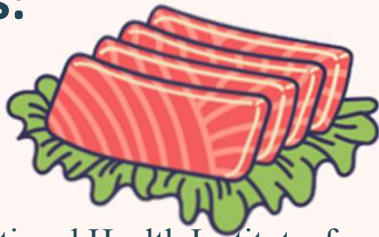
The sun's ultraviolet-B (UVB) rays cause the skin to produce vitamin D from cholesterol precursors; this process is the main source of vitamin D, which is why it is also known as "the sunshine vitamin." (Shetty, M. 2024). Sunlight causes our bodies to create vitamin D, but elements including time of day, skin tone, and sunscreen use can influence our production of this vitamin. It is recommended that people should expose their face and arms several times a week between 15 to 30 minutes in sunlight to keep sufficient levels. Finding a balance is critical as too much sun exposure raises our risk of skin damage and skin cancer.

Karpinski and Rosenbloom (2017) state that people who are confined to indoor living, geographic location or with limited use of sunscreen may make it difficult to acquire the proper amount of sunlight on their skin. Especially if they live north of 42' latitude (Northern US or Canada). These individuals should acquire Vitamin D from supplements during the winter months because of the decreased amount of sunlight exposure.



# Where can Vitamin D be found in Food?

## Food Sources:



According to the National Health Institute, few foods naturally contain vitamin D. Fortified foods provide most of the vitamin D in diets. A person should consult with the Nutrition Fact label for the amount of vitamin D in food or beverages.

Almost all of U.S. milk supply is fortified with about 3 mcg (120 IU) vitamin D per cup. Many plant-based alternatives such as soy milk, almond milk, and oat milk are similarly fortified. But foods made from milk, like cheese and ice cream, are usually not.

- ✓ Milk
- ✓ Breakfast cereals - Vitamin D is added to many breakfast cereals
- ✓ Orange juice, yogurt, margarine
- ✓ Fatty fish (trout, salmon, tuna, mackerel, sardines) and fish liver oils are among the best natural sources of vitamin D
- ✓ Beef liver, egg yolks, and cheese have small amounts of vitamin D
- ✓ Mushrooms provide a little vitamin D. Some mushrooms have been exposed to ultraviolet light to increase their vitamin D content.



Nutrition Facts	
Serving Size 1 cup	
Amount per serving	
<b>Calories</b>	<b>115</b>
	<b>% Daily Value*</b>
<b>Total Fat</b> 2.5g	<b>4%</b>
Saturated Fat 1.5g	<b>8%</b>
Trans Fat 0g	
<b>Cholesterol</b> 10mg	<b>4%</b>
<b>Sodium</b> 115mg	<b>5%</b>
<b>Total Carbohydrate</b> 12g	<b>4%</b>
Dietary Fiber 0g	<b>0%</b>
Total Sugars 12g	
Includes 0g of Added Sugars	<b>0%</b>
<b>Protein</b> 8g	<b>16%</b>
Vitamin D 2.5mcg	<b>13%</b>
Calcium 314mg	<b>30%</b>
Iron 0mg	<b>0%</b>
Potassium 397mg	<b>9%</b>

\*The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

The amount of Vitamin D a food has can be found under the Total Carbohydrate section of the Nutrition Facts label.

% Daily Value tells you how much of a nutrient a food has compared to how much someone needs each day.

This food contains 13% of the recommended daily value, making it a good source of Vitamin D.

Example of a Nutrition Fact label (Center for Nutrition in Schools)

# Vitamin D amounts contained in selected foods

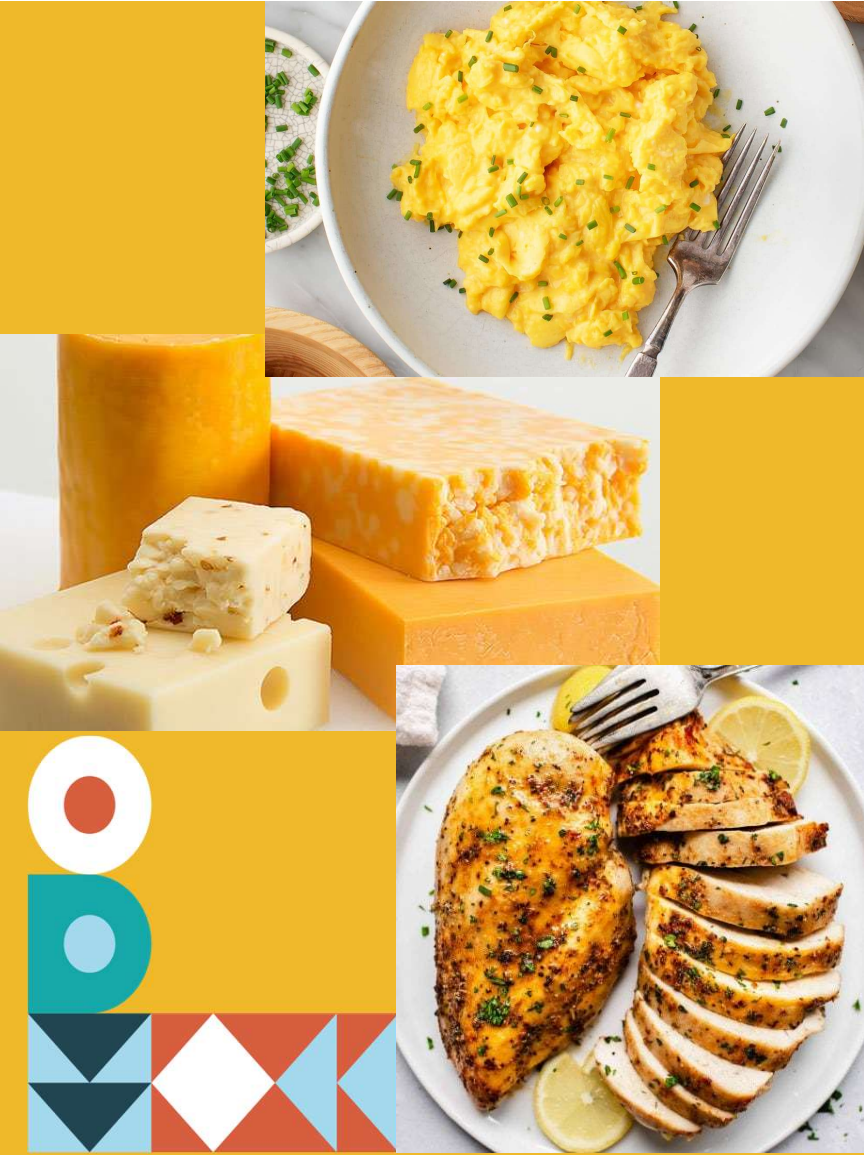
Table 3: Vitamin D Content of Selected Foods [25]

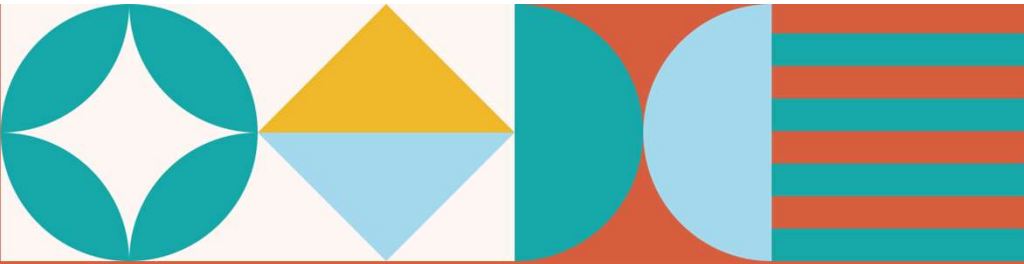
Food	Micrograms (mcg) per serving	International Units (IU) per serving	Percent DV*
Cod liver oil, 1 tablespoon	34.0	1,360	170
Trout (rainbow), farmed, cooked, 3 ounces	16.2	645	81
Salmon (sockeye), cooked, 3 ounces	14.2	570	71
Mushrooms, white, raw, sliced, exposed to UV light, ½ cup	9.2	366	46
Milk, 2% milkfat, vitamin D fortified, 1 cup	2.9	120	15
Soy, almond, and oat milks, vitamin D fortified, various brands, 1 cup	2.5–3.6	100–144	13–18
Ready-to-eat cereal, fortified with 10% of the DV for vitamin D, 1 serving	2.0	80	10
Sardines (Atlantic), canned in oil, drained, 2 sardines	1.2	46	6
Egg, 1 large, scrambled**	1.1	44	6
Liver, beef, braised, 3 ounces	1.0	42	5
Tuna fish (light), canned in water, drained, 3 ounces	1.0	40	5
Cheese, cheddar, 1.5 ounce	0.4	17	2
Mushrooms, portabella, raw, diced, ½ cup	0.1	4	1
Chicken breast, roasted, 3 ounces	0.1	4	1
Beef, ground, 90% lean, broiled, 3 ounces	0	1.7	0

National Institute of Health (2024, July)

\* DV = Daily Value. The FDA developed DVs to help consumers compare the nutrient contents of foods and dietary supplements within the context of a total diet. The DV for vitamin D is 20 mcg (800 IU) for adults and children age 4 years and older [26]. The labels must list vitamin D content in mcg per serving and have the option of also listing the amount in IUs in parentheses. Foods providing 20% or more of the DV are considered to be high sources of a nutrient, but foods providing lower percentages of the DV also contribute to a healthful diet.

\*\* Vitamin D is in the yolk.





## Recommended Daily Intake Amount

**Table 2: Recommended Dietary Allowances (RDAs) for Vitamin D [1]**

Age	Male	Female	Pregnancy	Lactation
0-12 months*	10 mcg (400 IU)	10 mcg (400 IU)		
1-13 years	15 mcg (600 IU)	15 mcg (600 IU)		
14-18 years	15 mcg (600 IU)	15 mcg (600 IU)	15 mcg (600 IU)	15 mcg (600 IU)
19-50 years	15 mcg (600 IU)	15 mcg (600 IU)	15 mcg (600 IU)	15 mcg (600 IU)
51-70 years	15 mcg (600 IU)	15 mcg (600 IU)		
>70 years	20 mcg (800 IU)	20 mcg (800 IU)		

National Institute of Health (2024, July)

Different professional groups and many other countries around the world have slightly different vitamin D recommendations. These variations happen because we don't fully understand how vitamin D works in the body and what effects it has on health. Also, the guidelines are meant for different purposes, such as public health in a healthy population or clinical practice. In some guidelines, recommendations are based on observational studies rather than randomized clinical trials.

According to National Institute of Health (2024) the recommended Dietary Allowance (RDA) is shown to the left.

The average daily level of intake sufficient meets the nutrient requirements of nearly all (97%–98%) healthy individuals; often used to plan nutritionally adequate diets for individuals.

RDAs for vitamin D are listed in both micrograms (mcg) and International Units (IU); 1 mcg vitamin D is equal to 40 IU.

### How much should an Athlete take?

Athletes should get between 2000 and 6000 IU of vitamin D every day.

Recent studies show that athletes may need more than 10,000 IU of vitamin D supplements in some cases. However, more research is needed to fully understand the effects of mega-dose vitamin D in athletes. (Yoon et al, 2021).

### What is the established upper limit amount?

**Table 4: Tolerable Upper Intake Levels (ULs) for Vitamin D [1]**

Age	Male	Female	Pregnancy	Lactation
0-6 months	25 mcg (1,000 IU)	25 mcg (1,000 IU)		
7-12 months	38 mcg (1,500 IU)	38 mcg (1,500 IU)		
1-3 years	63 mcg (2,500 IU)	63 mcg (2,500 IU)		
4-8 years	75 mcg (3,000 IU)	75 mcg (3,000 IU)		
9-18 years	100 mcg (4,000 IU)	100 mcg (4,000 IU)	100 mcg (4,000 IU)	100 mcg (4,000 IU)
19+ years	100 mcg (4,000 IU)	100 mcg (4,000 IU)	100 mcg (4,000 IU)	100 mcg (4,000 IU)

According to National Institute of Health (2024) excess amounts of vitamin D are toxic, so it is best to follow medical guidelines and speak with your Doctor.





# Vitamin D Deficiency and Toxicity

Having a Vitamin D shortage means that a person's body doesn't have enough vitamin D. This can lead to health problems like weak muscles and bones that break easily. Many people aren't getting enough vitamin D because they don't have any symptoms and vitamin D is something that Doctors don't check levels often. According to National Institute of Health (2024) excess amounts of vitamin D are toxic, so it is best to follow medical guidelines and speak with your Doctor.

Research suggests vitamin D deficiency increases the risk of autoimmune disease and non-skeletal chronic disease – It can affect muscle function, weakness and inflammation.

## What causes these deficiencies?

People who don't have adequate levels of vitamin D may be deficient for any of these reasons:

- Not enough exposure to sunlight
- Darker skin pigment
- Malnutrition
- Kidney or liver failure, which prevents the body from adequately processing vitamin D
- Certain medications
- Certain types of cancer, such as lymphoma
- A family history of vitamin D deficiency or childhood rickets

Vitamin D insufficiency is readily addressed. Upon diagnosis and attention to treatment recommendations, people will likely be able to elevate the intake to an acceptable amount, so relieving any symptoms or long-term complications. Most can be treated with supplements and diets.

## Possible symptoms:

Most people with vitamin D deficiency don't notice any symptoms. Others may notice vague symptoms that may be signs of any number of conditions.

Possible symptoms include:

- Muscle pain
- Bone pain
- Increased sensitivity to pain
- A tingly, "pins-and-needles" sensation in the hands or feet
- Muscle weakness in body parts near the trunk of the body, such as the upper arms or thighs
- Waddling while walking, due to muscle weakness in the hips or legs
- A history of broken bones
- Muscle twitches or tremors
- Muscle spasms
- Bowed legs (when the deficiency is severe)



# Sport Performance and Ergogenic Aid

## Sports Performance

For an athlete who takes the recommended supplement amounts of Vitamin D, they can increase their sports performance. Research has shown that they can increase muscle protein synthesis, ATP concentration, strength, jump height, jump velocity, jump power, exercise capacity, and physical performance are achieved with increased vitamin D levels. Additionally, increased levels of vitamin D decrease muscle protein degeneration and reverse myalgias. Supplementation benefits are not limited to muscle alone. Vitamin D plays an important role in bone health and fracture prevention.

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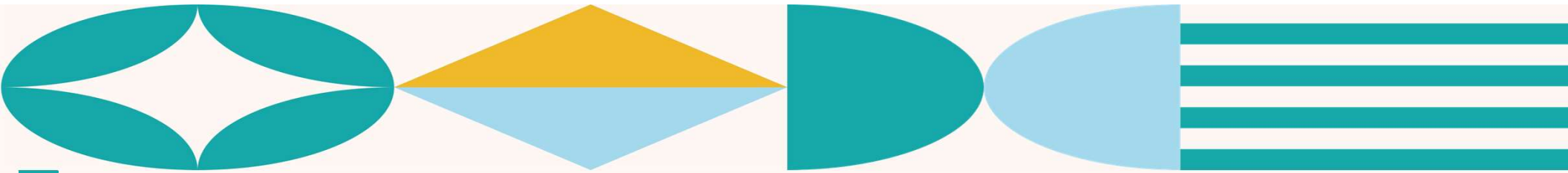
## Ergogenic Aid

Evidence indicates that vitamin D may have an ergogenic effect on certain performance-related measures. However, it is evident that these advantages may manifest solely in persons who were deficient previous to supplementation.

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## Benefits of Vitamin D

Vitamin D supplementation has already been widely accepted for musculoskeletal health benefits and disease prevention.



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# The End

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