

Vitamin D

Infos assembled by Jimmy

All the references are displayed at the end of the document

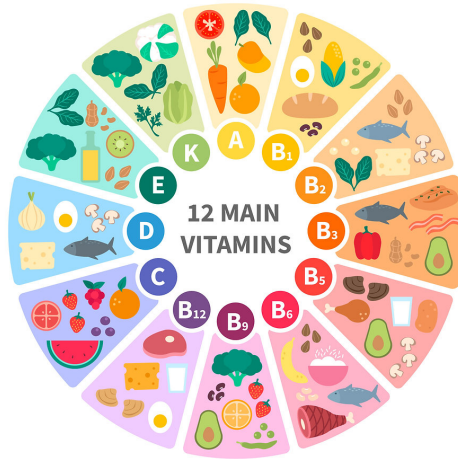


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1 What are vitamins, in general ?

Simply put, vitamins are vital substances for the well-being of a person. They are active in growth, skeletal development, use of micro-nutrients (like Calcium, Zinc, Magnesium, Phosphorus etc.), sight (e.g. Vitamin A), blood clotting, nervous system and immune system, DNA production, etc. [4].



However, the body CANNOT synthesize (aka produce) vitamins by itself, EXCEPT Vitamin D which is the main focus of this paper, and vitamin K. An appropriate intake of vitamins can prevent cancer, cardiovascular diseases and many age-related diseases. Overconsumption of vitamins can be toxic for the body and vitamin deficiency can lead to clinical or pathological disorders.

Vitamins DO NOT give energy as they contain 0 calorie, thus "faire le plein de vitamines pour avoir de l'énergie" is a misleading sentence, but having an adequate intake of all the needed vitamins is good to perform your daily activities and to keep your body healthy and functional.

2 What is Vitamin D ?

2.1 Types of Vitamin D

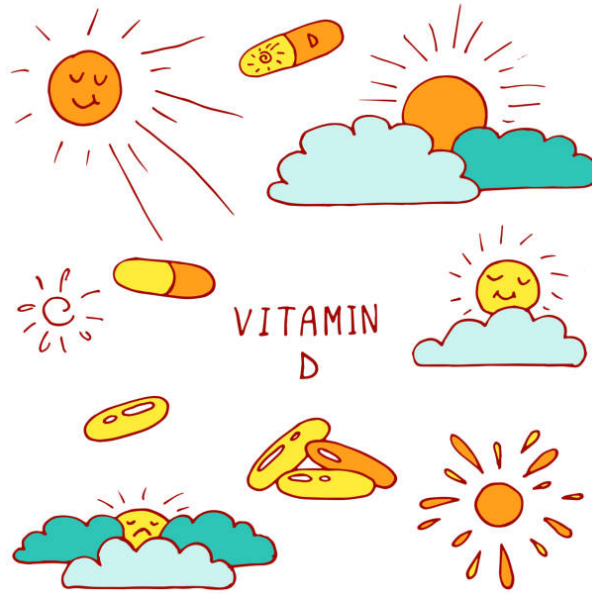
There are two types of Vitamin D (but they are very very similar nutritionally, so we group them as just "Vitamin D") : Vitamin D2 and Vitamin D3.

- Vitamin D2 (ergocalciferol) is found in plants and shrooms (pretty vegan friendly),
- Vitamin D3 (cholecalciferol) is mostly found in oily fish, egg yolk and fortified dairy products (a lot less vegan friendly).

Vitamin D is a liposoluble vitamin (in reality it is a hormone, but in practice a common mortal like me does not need to make that difference anyway), which means it dissolves in fat [4]. Because Vitamin D is stored in fat (in the liver and the body's fatty tissue), there is a higher risk of toxicity if the intake is too high. The amount of fat with which Vitamin D is ingested does not seem to significantly modify the bioavailability (aka absorption) of Vitamin D3 [8].

2.2 Synthesis by sunlight

If the body is exposed to the sunlight, it can synthesize this vitamin (more precisely Vitamin D3) in the skin by UV rays. 15 to 20 minutes in the sun (safely) is enough to get approximately 80% [1] your daily intake of Vitamin D, as sunlight is the major source of this vitamin. The remaining 20% is found in your diet.



People with darker skin can have a harder time synthesizing Vitamin D. Sunscreen, pollution, age and seasons can also impair its synthesis [20]. The body stops producing Vitamin D from sunlight when the needs are met, so over-exposition to sunlight for Vitamin D is useless [27] (or even dangerous, c.f. skin cancer [13]). Indeed, in longer exposure to sunlight, compounds called "lumesterol" are formed and they do not show Vitamin D activity [1].

2.3 Need for Magnesium

Vitamin D CANNOT be metabolized ("transformed via chemical reactions and used") by the body without the necessary Magnesium level. It means that, without enough Magnesium, Vitamin D is stored but not used. 50% of American are Magnesium deficient.

The recommended Magnesium intake is 420 micrograms for men and 320 micrograms for women. Foods high in magnesium include almonds, bananas, beans, broccoli, brown rice, cashews, egg yolk, fish oil, flaxseed, green vegetables, milk, mushrooms, other nuts, oatmeal, pumpkin seeds, sesame seeds, soybeans, sunflower seeds, sweet corn, tofu, and whole grains [6].

Vitamin D itself contributes to the good absorption of Magnesium [5], so these two compounds kinda have a love-love relationship.

2.4 Recommended Vitamin D daily intake

The recommended intake of Vitamin D is 600 IU (International Unit) per day for children and adults, and 800 IU for elders [11] [25]. IU is a unit used to measure vitamin activity and **differs for each substance**.

For Vitamin D, 40 IU = 1 microgram. Thus 600 IU = 15 micrograms and 800 IU = 20 micrograms.

3 Vitamin D benefits

Vitamin D plays a crucial role in the quality of bone tissues, muscular tissues and immune system, as almost every organ and cell in the body has a Vitamin D receptor [15].

3.1 Calcium and Phosphorus regulation

Vitamin D helps in absorbing Calcium (which, in itself, is not that easy to get) [4] [14] and Phosphorus in the blood.

3.1.1 Calcium

A good Calcium regulation leads to :

- Optimal tissue mineralization : bones, teeth and cartilage (ears, nose)
- Good muscular contraction
- Good nervous transmission
- Good coagulation (liquid blood changes into semisolid blood clots, which helps preventing blood loss from damaged blood vessels) [7]
- Good immune health and hormone regulation [17]
- Cell differentiation (an unspecialized cell that takes on individual characteristics to become a specialized cell [9])

Too much Vitamin D tends to increase Calcium levels too much in the blood, which is NOT good for cardiovascular and renal health. Plus, you can experience headaches, nausea or excessive fatigue [17].

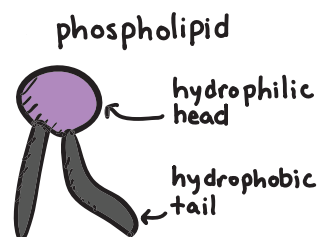
3.1.2 Phosphorus

Phosphorus is a very prominent component in the body and is fairly easy to find in food.

It helps with apoptosis (the natural and planned death of the cells) and it is a component of **ATP** (stands for "Adenosine TriPhosphate", that comes often in nutrition), which acts as the body primary source of energy.

Phosphorus is also found in DNA (which stores genetic information) and RNA (a messenger that helps to synthesize proteins). Thus, without Phosphorus, the body would NOT be able to properly create genes, proteins and new cells.

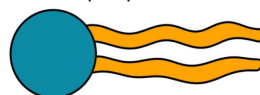
Furthermore, Phosphorus is part of compounds called "phospholipids" (Phosphorus + saturated fat + unsaturated fat, c.f. my document on olive oil for more infos on fats) that make up your cell membranes [12].



Types of Lipids: Phospholipids

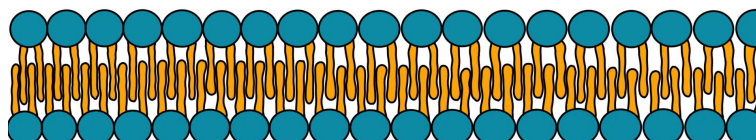
Phospholipids make up the cell membrane.

Each phospholipid consists of a phosphate head linked to 2 fatty acid chains.



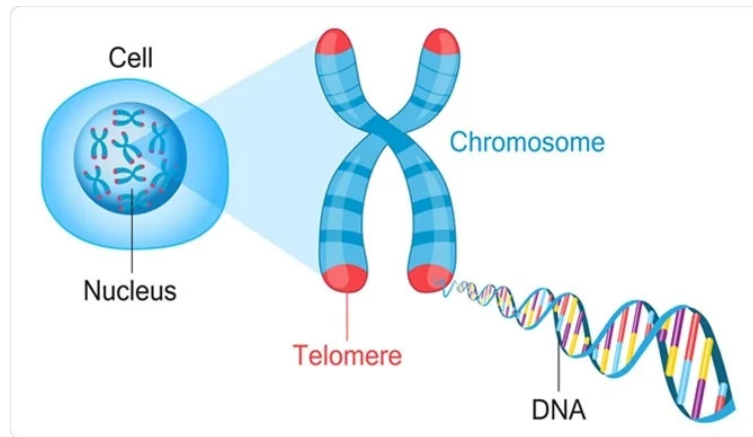
The head is hydrophilic and interacts with water. The tails are hydrophobic and hate water.

Phospholipids create two layers to make the cell's double membrane.



3.2 Slowing down cell aging

A very recent study (June 2025) [30] suggests that Vitamin D supplements may lead to a strategy to counter biological aging. Telomeres are regions of DNA [29] and shorten every time a cell divides. This shortening has been linked to aging and to age-related diseases like vascular dementia, type II diabetes, and cancer.



The study showed that the telomeres exposed to Vitamin D are longer than those which were not, and that is equivalent to 3 years of aging [23].

4 Vitamin D deficiency

Vitamin D deficiency is very common worldwide (1 billion children and adults at risk [16]). In Europe, 40% of the population has a Vitamin D deficiency [1]. During winter, in France, 75% of the population lacks Vitamin D [2]

For example, Vitamin D deficiency can lead to :

- Muscular issues (weakness, aches) [4] [14] [16]
- Rickets (soft and weak bones in children)
- Osteomalacia (decalcification of the bones, which can lead to bone deformation and a higher risk of fracture) [22],
- Osteoporosis (your bones become weak and brittle) [4]
- Multiple sclerosis (breakdown of the protective covering of nerves called "myelin") [10]
- Increased symptoms of depression and anxiety [1]
- Increased risk of cardiovascular diseases [16] [28]
- Increased risk of autoimmune diseases [16]
- Type I and Type II diabetes [14] [16] [31]
- Anemia (abnormal low level of hemoglobin, a substance which helps red blood vessels to carry oxygen to all organs)[4]
- Alzheimer's disease [16]
- Breast, colon, pancreas and prostate cancer [16] [18]

Furthermore, pregnant and lactating women need more Vitamin D than usual, as biochemical disturbances and bone issues can have occur in the infant [14]. In a study on 1048 pregnant women [21], 80% of them presented a Vitamin D deficiency. Another study from Karolina Lagowska [19] reported that low Vitamin D concentrations co-occur with disturbed menstrual cycles : women who did not meet the recommended level of Vitamin D had almost five times the odds of having menstrual cycle disorders as women who were above the recommended Vitamin D level.

5 Where to find Vitamin D ?



The main source of Vitamin D is the sunlight. Note that diet alone CANNOT make up the needed daily intake of Vitamin D [20]. Here are good sources of Vitamin D [3] [26]:

- Egg yolks
- Oily fish (poissons gras, e.g. salmon, tuna, anchovy, etc.)
- Some shrooms (e.g. girolles, cèpes etc.)
- Black chocolate
- Butter
- Vitamin D fortified products (e.g milk or cereals)
- Vitamin D complementation

It is possible to get the daily intake of Vitamin D while following a vegan diet, as Vitamin D3 is produced by sun exposition and Vitamin D2 is mostly found in plants, c.f. Section 2.

Fun fact : Vitamin D food fortification is the lowest in France [24].

6 Conclusion

As Vitamin D is used almost everywhere in our body, it is important to have an adequate intake of this vitamin. Taking advantage of our ability to synthesize it easily, going out in the sunlight every day is an excellent way to meet our daily Vitamin D intake. Moreover, it is also very important to have an adequate intake of Magnesium to properly metabolize Vitamin D in the body.

However, Vitamin D is one of the most common deficiency, thus Vitamin D rich food and complementation may help to solve this issue, while being careful as to not consume it in excess to avoid unwanted health issues.

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