

## Selected Questions and Answers on Vitamin D

Joint FAQs to the BfR, German Nutrition Society (DGE) und Max Rubner-Institute (MRI) of 03 December 2014<sup>1</sup>

Vitamin D promotes the intake of calcium from the gastrointestinal tract and hardens the bones. It influences muscle power, regulates the calcium and phosphate metabolism and is also involved in other metabolic processes in the body. Vitamin D is formed in human skin under the influence of sunlight. In contrast to the quantity the body produces by itself, vitamin D intake via food accounts for only a relatively low percentage of the vitamin D supply. The Deutsche Gesellschaft für Ernährung e. V. (DGE, German Nutrition Society) estimates 20 micrograms of vitamin D per day to be an appropriate intake for children, teenagers and adults if the body does not produce any by itself (<http://www.dge.de/pdf/ws/Referenzwerte-2012-Vitamin-D.pdf>)

General enrichment of foods with vitamin D is not recommended. The focus is on the body's own production of vitamin D, hence the recommendation to produce and store vitamin D by means of sunshine on the skin. The amount the body produces by itself varies from person to person and depends on other factors, such as latitude and the time of year. Exposure to the sun for a total of approximately 5 to 25 minutes per day with the face, hands and large parts of the arms and legs uncovered is recommended. The intake of vitamin D preparations is only recommended, especially for risk groups, if a targeted improvement of the supply cannot be achieved through food or the body's own vitamin D production through exposure to sunshine.

The BfR, DGE and MRI have summarised below some frequently asked questions and answers on vitamin D.

### **What is vitamin D and why does the body need it?**

Vitamin D takes up a special position among the vitamins. Unlike the other vitamins, vitamin D can be produced through preliminary stages that already exist in the body. The body's own production is triggered by sunshine on the skin (UVB light exposure) and makes a much bigger contribution to the supply of the human body with this vitamin compared to vitamin D intake through food. Vitamin D regulates the calcium and phosphate metabolism, thereby promoting hardening of the bones. Vitamin D is also involved in other metabolic processes in the body, however, and also has an influence on muscle power.

### **How much vitamin D does the human body need and how can the vitamin D supply be determined?**

The reference value for vitamin D intake is 20 micrograms per day if the body does not produce any by itself. This estimated value, which the DGE derived from various studies, applies to all age groups from one year.

If a person stays outdoors regularly under the conditions predominant in this country, the body's own (endogenous) production in the skin accounts for 80 to 90 percent of the vitamin D supply.

In contrast to this, vitamin D intake through customary foods only accounts for a relatively low proportion (10 to 20 percent) of the vitamin D supply, which is why recording this form of intake is not suitable for assessing the actual supply situation. The concentration of 25-

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<sup>1</sup> Updated version of the FAQ of 22 October 2012

hydroxyvitamin D in blood serum is used as the marker for assessing the supply because it reflects vitamin D intake through food and the body's own vitamin D production.

Persons are said to have a vitamin D deficiency with serum concentrations of the marker 25-hydroxyvitamin D of below 30 nanomoles per litre of serum (30 nmol/l). This equates to 12 nanograms per millilitre of serum (12 ng/ml). Persons are said to have a good vitamin D supply in relation to healthy bones if the blood concentration of this marker is at least 50 nanomoles per litre of serum. This equates to 20 nanograms per millilitre. If the body does not produce any vitamin D by itself, this concentration is reached with an intake of 20 micrograms of vitamin D per day.

As a vitamin D deficiency is not to be assumed with the majority of the German population, the vitamin D supply should only be determined when there is a justified suspicion of a deficiency or with persons with a higher risk.

### **How is the vitamin D supply of the German population? Is there a supply gap?**

Although the majority of the population does not have a vitamin D deficiency, almost 60 percent of German citizens do not reach the desired blood concentration of the marker 25-hydroxyvitamin D of 50 nanomoles per litre. This means that a large percentage of the population is not making full use of the preventive potential of vitamin D for healthy bones and is therefore not sufficiently supplied.

### **How much sun does the body need to produce sufficient vitamin D by itself? How do autumn and winter compare to summer?**

The body's own vitamin D production in the skin through sunlight (UVB radiation) depends on latitude, the time of year and day, weather conditions, clothing, the length of time spent outdoors and skin type, as well as the use of sun protection products which reduce the body's own production. This means that the contribution to the vitamin D supply made by the body's own production can fluctuate strongly from one individual to another. Accordingly, the body's own contribution to vitamin D supply in terms of quantity cannot be determined for individual persons or the population as a whole.

It is possible in the summer months to reach the desired serum concentration of 25-hydroxyvitamin D of 50 nmol/l by means of the body's own production through exposure to sunlight, the intensity of which depends on the geographical location. Accordingly, and depending on skin type and season, it is sufficient for adults in Germany, a country which extends from latitudes 47 to 55 °N, to expose a quarter of the surface area of the body (face, hands and parts of the arms and legs) to the sun every day for roughly half of the year for 5 to 25 minutes.

Unlike the summer months, solar radiation in Germany is not strong enough from October to March to guarantee sufficient vitamin D production, although it can be stored in the body. These deposits contribute to vitamin D supply in winter. The deposits, which are depleted over the winter months, are then replenished from the springtime through to autumn.

### **How is an organism able to store vitamin D?**

Vitamin D is stored mainly in the fat and muscle tissue of the human body, with smaller quantities in the liver. Overall storage capacity is relatively large and contributes to vitamin D supply in winter.

### How much vitamin D is contained in foods?

There are only a few foods, most of them of animal origin, which contain vitamin D in any significant quantities. These include in particular fatty fish (e.g. salmon, herring, mackerel) and to a considerably lesser extent liver, margarine (enriched with vitamin D), egg yolk and several edible mushrooms. Here in Germany, vitamin D intake via standard foods is only 2 to 4 micrograms per day.

**Table: Vitamin D concentrations of several standard foods (according to Souci/Fachmann/ Kraut, 2008)**

Food	Vitamin D (Micrograms per 100 grams)
Herring	7.80 – 25.00
Salmon	16.00
Hen egg yolk	5.60
Mackerel	4.00
Hen eggs, total	2.90
Margarine	2.5 – 7.5*
Chanterelle mushrooms	2.10
Button mushrooms	1.90
Beef liver	1.70
Gouda cheese, 45% fat i.d.m.	1.30
Butter	1.20
Calf's liver	0.33
Full-fat milk, 3.5% fat	0.09

\* Exceptional permission for up to 7.5 micrograms per 100 grams has been granted

### What are the consequences of vitamin D deficiency?

If a vitamin D deficiency occurs during infancy and childhood, the bones do not receive enough minerals, which means that they remain soft and can deform (rickets). Disorders of the bone metabolism can also result in adults. The bones can become soft through demineralisation (osteomalacia). A vitamin D deficiency can also contribute to the occurrence of osteoporosis, especially with the elderly. The condition of an inadequate supply of vitamin D with which the preventive potential of the vitamin for healthy bones is not used to a sufficient extent has to be distinguished from an actual vitamin D deficiency with clinical symptoms. What this means is that the benefits of an adequate vitamin D supply – a reduced risk of susceptibility to falls and fractured bones in elderly people – are eliminated.

### What groups are at risk of a vitamin D undersupply?

The risk groups for an undersupply include people who (can) hardly ever get out of doors or who – often for cultural or religious reasons – only go outdoors with their body completely covered. They also include people with a dark skin (high melanin concentration), because they cannot produce as much vitamin D as people with a light skin. Older people constitute another important risk group because vitamin D production reduces significantly with age and the problems of restricted mobility, chronic illness and care dependency also increase among elderly people who (can) hardly ever get out of doors. Suckling babies are also a risk group for vitamin D undersupply because the vitamin D content of breast milk is very low on the one hand and babies should fundamentally not be exposed to direct sunlight on the other, because the protection mechanism in their skin still has to develop.

### Does the body's own vitamin D production remain sufficient the older people become?

The skin's ability to produce vitamin D diminishes significantly the older a person gets and can be reduced to less than half compared to younger people. If less time is spent outdoors at the same time, so that skin exposure to the sun is limited, the body's own vitamin D production is further diminished. This occurs very often with older people with restricted mobility,

chronic illness and care dependency (nursing home occupants, geriatric patients) who are often diagnosed with a vitamin D deficiency. This does not generally apply to (older) people who spend a lot of time out of doors.

### **Should people go to the solarium to improve their vitamin D supply?**

It doesn't make sense to visit a solarium in order to improve the vitamin D supply. According to a recommendation issued by the Federal Office for Radiation Protection (BFS), children and teenagers in particular should not go to the solarium. In the opinion of the Federal Office for Radiation Protection, visits to a solarium can increase the risk of skin cancer.

### **Is an oversupply of vitamin D possible through the body's own synthesis?**

Vitamin D overdoses and the undesired effects connected with them are only possible through excessive oral intake (> 100 micrograms per day over a longer period) and not through overexposure to sunlight.

### **What should be observed with frequent exposure to sunlight?**

Too much exposure to sunlight increases the risk of contracting skin cancer and for this reason, frequent and intensive exposure to solar radiation around mid-day in summer is not recommended (in compliance with the recommendations of German Cancer Aid). A recommendation to avoid the sun is not sensible or necessary either, however. Outdoor physical activity is highly recommended, whereas sunburn should be avoided at all costs by taking suitable measures.

### **Is the consumption of vitamin D preparations or foods enriched with vitamin D necessary?**

The enrichment of foods with vitamin D is not recommended. Main focus is placed on the body's own production of vitamin D, hence the recommendation to produce it through exposure of the skin to the sun. The intake of vitamin D preparations (i.e. additional intake through foods) is only recommended if an insufficient supply has been diagnosed and if a targeted improvement of the vitamin D supply cannot be achieved either through food or the body's own vitamin D production through sunlight exposure. These risk groups include:

People who hardly ever go outside when the sun is shining or only with their body completely covered, as well as dark-skinned persons. Groups who do not expose themselves to the sun regularly and sufficiently include in particular older people with restricted mobility, chronic illness and care dependency (nursing home occupants, geriatric patients, elderly people with a risk of osteoporosis and falling). Compared to other groups, serious incidences of vitamin D undersupply or deficiency requiring treatment occur more frequently in these groups. On top of this, the skin's ability to produce vitamin D decreases significantly with age and the body's own contribution to vitamin D supply is further diminished when exposure to sunlight is insufficient. With breast-fed and non-breast-fed babies, a sufficient vitamin D intake is ensured by giving them a vitamin D tablet to prevent rickets from the first week to the end of the first year of their lives.

### **Does a vitamin D oversupply have any effects on health?**

Vitamin D overdoses and the possible side-effects connected with them are only possible through excessive oral intake and not through overexposure to sunlight.

In the event of additional intake of vitamin D through vitamin D preparations, it should be taken into account that the European Food Safety Authority (EFSA) has derived a tolerable total intake quantity of 100 micrograms of vitamin D per day for adults and children aged 11 and over, and 50 micrograms per day for children aged up to 10. These tolerable total intake

quantities per day relate to vitamin D intake from all foods (including vitamin D preparations and enriched foods).

With a regular daily intake of over 100 micrograms of vitamin D, which with normal eating habits is only currently possible by means of the excessive intake of vitamin D preparations, undesired effects such as the formation of kidney stones or calcification can occur. Higher vitamin D intake quantities can be prescribed for medical reasons, however.

**Does the intake of vitamin D preparations protect against cancer or other diseases?**

The data current available confirm that a good vitamin D supply in older people can lower the risk of falling, broken bones, loss of strength, mobility and balance impairments and premature death. There is no clear evidence on the other hand that vitamin D lowers the risk of contracting cancer, cardiovascular diseases or diabetes mellitus Type 2.

**What can consumers do?**

Consumers should get out into the fresh air as often as possible in both summer and winter. Along with sports, physical exercise and activities in the open air strengthen the muscles and bones. The consumption once or twice a week of fatty saltwater fish, which contain n-3 fatty acids and iodine in addition to vitamin D, is recommended. A good vitamin D supply can be achieved without the additional intake of vitamin D preparations by staying outdoors for sufficient periods with simultaneous exposure to sunlight and by maintaining a balanced diet.

You will find more information on the subject of “UV exposure for the production of vitamin D in the body” at:

[http://www.bfs.de/de/uv/uv2/wirkungen\\_uv\\_strahlung/akut/Konsentierete\\_Empfehlung.html](http://www.bfs.de/de/uv/uv2/wirkungen_uv_strahlung/akut/Konsentierete_Empfehlung.html)