Vitamin D

Vitamin D is a vitamin that is needed for good health, growth and strong bones . Unlike other vitamins, we do not need to get vitamin D from food. A main source of vitamin D is made by our own bodies. It is made in the skin by the action of sunlight. This is a good thing because most foods contain no or very little vitamin D naturally. Foods that contain vitamin D include:

- Oily fish (such as sardines, pilchards, herring, trout, tuna, salmon and mackerel).
- Fortified foods (this means they have vitamin D added to them) such as margarine, some cereals, infant formula milk.

Only infant formula milk and margarine have statutory vitamin D supplementation in the UK. Egg yolk, liver, and wild mushrooms contain only small quantities of vitamin D.

Vitamin D and sunlight

Ultraviolet B (UVB) rays in sunlight convert cholesterol in the skin into vitamin D. For a fair-skinned person, it is estimated that around 20-30 minutes of sunlight on the face and forearms around the middle of the day 2-3 times a week is sufficient to make enough vitamin D in the summer months in the UK. However, for people with darker skin and the elderly, the amount of time needed exposed to sunlight to make enough vitamin D can be much more than this. **Note**: it is not the same as sunbathing; the skin simply needs to be exposed to sunlight. But, the sunlight has to fall directly on to bare skin (through a window is not enough).

For six to nine months of the year (October to April), much of western Europe (above 50 latitude - including 90% of the UK) lies too far north to have enough UVB rays in sunlight necessary to make vitamin D in the skin. So, many people in the UK are at risk of not getting enough vitamin D unless they get it in their diet.

Note: too much exposure to the sun's rays can be damaging. Sunburn should be avoided at all costs (mainly because it can increase your risk of skin cancer).

Why do we need vitamin D?

A main action of vitamin D is to help calcium and phosphorus in our diet to be absorbed from the gut. Calcium and phosphorus are needed to keep bones healthy and strong. So, vitamin D is really important for strong and healthy bones. In addition, vitamin D seems to be important for muscles and general health. There is also some evidence that vitamin D may also help to prevent other diseases such as cancer, diabetes and heart disease.

Who gets vitamin D deficiency?

Vitamin D deficiency means that there is not enough vitamin D in your body. Broadly speaking, this can occur in three situations:

1) Increased need for vitamin D

Growing children, pregnant women, and breast-feeding women need extra vitamin D because it is required for growth. So, vitamin D deficiency is more likely to develop in the following groups of people:

- Pregnant or breast-feeding women. Vitamin D deficiency is even more likely to develop in women who have had several babies with short gaps between pregnancies. This is because the body's stores of vitamin D get used up, and there is little time for them to be built up before another pregnancy.
- Breast-fed babies whose mothers are lacking in vitamin D, or with prolonged breast-feeding, as there is little vitamin D in breast milk. (**Note**: there are significant advantages to breast-feeding. You should not stop breast-feeding due to concern about vitamin D levels - your baby can simply have vitamin D supplements as drops by mouth.)

2) Where the body is unable to make enough vitamin D

- People who get very little sunlight on their skin are at risk of vitamin D deficiency. This is more of a problem in the more northerly parts of the world (including the UK) where there is less sun. In particular:
  - People who stay inside a lot. For example, those in hospital for a long time, or housebound people.
  - People who cover up a lot of their body when outside. For example, wearing veils such as the niqab or burqa.
  - Strict sunscreen use can potentially lead to vitamin D deficiency, particularly if high sun protection factor (SPF) creams (factor 15 or above) are used. Nevertheless, children especially should **always** be protected from the harmful effect of the sun's rays and should never be allowed to burn or be exposed to the strongest midday sun.
- Elderly people have thinner skin than younger people and so are unable to produce as much vitamin D. This leaves older people more at risk of vitamin D deficiency.
- People who have darker skin. For example people of African, African-Caribbean and South Asian origin, because their bodies are not able to make as much vitamin D.
- Some medical conditions can affect the way the body handles vitamin D. People with Crohn's disease, coeliac disease, and some types of liver and kidney disease, are all at risk of vitamin D deficiency.
- Rarely, some people without any other risk factors or diseases become deficient in vitamin D. It is not clear why this occurs. It may be due to a subtle metabolic problem in the way vitamin D is made or absorbed. So, even some otherwise healthy, fair-skinned people who get enough sun exposure can become deficient in vitamin D.
- Vitamin D deficiency can also occur in people taking certain medicines. Examples include: carbamazepine, phenytoin, primidone, barbiturates and some anti-HIV medicines.

3) Not enough dietary vitamin D
Vitamin D deficiency is more likely to occur in people who follow a strict vegetarian or vegan diet, or a non-fish-eating diet.

How common is vitamin D deficiency?

It is very common. A recent survey in the UK showed that more than half of adults in the UK did not have enough vitamin D. In the winter and spring about 1 in 6 people have a severe deficiency. It is estimated that about 9 in 10 adults in the UK of South Asian origin may be vitamin D-deficient. Most affected people either don't have any symptoms, or have tiredness or vague aches and pains, and are unaware of the problem.

What are the symptoms of vitamin D deficiency?

Many people have no symptoms, or only vague ones such as tiredness or general aches. Because symptoms of vitamin D deficiency are often very nonspecific or vague, the problem is often missed. The diagnosis is more easily reached in severe deficiencies with some of the classical (typical) symptoms and bone deformities.

Symptoms in babies and children

- Babies with severe vitamin D deficiency can get muscle spasms (cramps), seizures and breathing difficulties. These problems are related to consequent low levels of calcium.
- Children with severe deficiency may have soft skull or leg bones. Their legs may look curved (bow-legged). They may also complain of bone pains, often in the legs, and muscle pains or muscle weakness. This condition is known as rickets.
- Poor growth. Height is usually affected more than weight. Affected children might be reluctant to start walking.
- Tooth delay. Children with vitamin D deficiency may be late teething as the development of the milk teeth has been affected.
- Irritability in children can be due to vitamin D deficiency.
- Children with vitamin D deficiency are more prone to infections. Respiratory (breathing) symptoms can occur In severe cases. Breathing can be affected because of weak chest muscles and a soft ribcage.
- When rickets if very severe, it can cause low levels of calcium in the blood. This can lead to muscle spasms (cramps), seizures and breathing difficulties. These need urgent hospital treatment.
- Fractures with relatively low levels of trauma have been linked to Vitamin D deficiency.
- Rarely, an extremely low vitamin D level can cause weakness of the heart muscle (cardiomyopathy).

Symptoms in adults

- General tiredness, vague aches and pains and a general sense of not being well are the common symptoms.
- In more severe deficiency (known as osteomalacia), there may be more severe pain and also weakness. Muscle weakness may cause difficulty in climbing stairs or getting up from the floor or a low chair, or can lead to the person walking with a waddling pattern.

- Bones can feel painful to moderate pressure (often more noticeable in the ribs or shin bones). Not uncommonly, people have a hairline fracture in the bone which is causing tenderness and pain. Bone pain often also occurs in the lower back, hips, pelvis, thighs and feet.

How is vitamin D deficiency diagnosed?

It may be suspected from your medical history, symptoms, or lifestyle. A simple blood test for vitamin D level can make the diagnosis. Blood tests for calcium and phosphate levels and liver function may also show changes linked to a low level of vitamin D. Sometimes, a wrist X-ray is done for a child. This can assess how severe the problem is by looking for changes in the wrist bones.

What is the treatment for vitamin D deficiency?

The treatment is to take vitamin D supplements. This is a form of vitamin D called ergocalciferol or calciferol. Vitamin D can be given as an injection or as a medicine (liquid or tablets). Your doctor will discuss the dose, and best treatment schedule, depending on your situation, age, severity of the deficiency, etc. Briefly, one of the following may be advised

Injection
A single small injection of vitamin D will last for about six months. This is a very effective and convenient treatment. It is useful for people who do not like taking medicines by mouth, or who are likely to forget to take their tablets.

High-dose tablets or liquids
There are different strengths available and a dose may be taken either daily, weekly or monthly. This will depend on your situation and on which particular treatment guideline your doctor is using. Always check with your doctor that you understand the instructions - with high doses of vitamin D it is important to take the medicine correctly. The advantage of the higher-dose treatment is that the deficiency improves quickly - important in growing children.

It may be suggested that an average size adult take up to 4000 units a day for three months and then reduce thereafter to 1000 units a day.

Standard-dose tablets, powders or liquids
These are taken every day for about 12 months so that the body can catch up on the missing vitamin D. This is a rather slow method of replacing vitamin D, but is suitable if the deficiency is mild, or for prevention.

Maintenance therapy after deficiency has been treated
After vitamin D deficiency has been treated, the body's stores of vitamin D have been replenished. After this, *maintenance* treatment is often needed long-term, to prevent further deficiency in the future. This is because it is unlikely that any risk factor for vitamin D deficiency in the first place will have completely resolved. The dose needed for maintenance may be lower than that needed to treat the deficiency.

Preventing vitamin D deficiency

Various groups of people (detailed earlier) are prone to develop vitamin D deficiency. Therefore, certain people are advised to take vitamin D supplements routinely. In July 2016 new advice on vitamin D from Public Health England (PHE) had the following recommendations:

The full report is here: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/537616/SACN_Vitamin_D_and_Health_report.pdf

- Adults and children over the age of one should consider taking a daily supplement containing 10mcg (400iu) of vitamin D, particularly during autumn and winter.
- This includes pregnant and breast-feeding women.
- People who have a higher risk of vitamin D deficiency (including people whose skin has little or no exposure to the sun, like those in care homes, or people who cover their skin when they are outside and people with dark skin) are being advised to take a supplement all year round.
- Children aged one to four years should have a daily 10mcg vitamin D supplement all year round.
- Babies under one year should have a daily 8.5 -10mcg vitamin D supplement **in the form of vitamin drops**.
- However, those infants who are fed infant formula will not need vitamin drops until they are receiving less than 500ml of infant formula a day, as these products are fortified with vitamin D.

You can buy vitamin D supplements at pharmacies. They are also available on prescription to certain groups of people. Also, women and children from families who are eligible for the Government's Healthy Start scheme can also get free vitamin supplements which include vitamin D.

If you are unsure as to whether you should be taking a regular supplement of vitamin D, or the appropriate dose, then your doctor, pharmacist, health visitor or midwife can advise.

Cautions when taking vitamin D supplements

Care is needed with vitamin D supplements in certain situations:

- If you are taking certain other medicines: digoxin (for an irregular heartbeat - atrial fibrillation) or thiazide diuretics such as bendroflumethiazide (commonly used to treat high blood pressure). In this situation, avoid high doses of vitamin D, and digoxin will need monitoring more closely.
- If you have other medical conditions: kidney stones, some types of kidney disease, liver disease or hormonal disease. Specialist advice may be needed.
- Vitamin D should **not** be taken by people who have high calcium levels or certain types of cancer.
- You may need more than the usual dose if taking certain medicines which interfere with vitamin D. These include: carbamazepine, phenytoin, primidone, barbiturates and some medicines for the treatment of HIV infection.

Multivitamins are not suitable for long-term high-dose treatment because the vitamin A they also contain can be harmful in large amounts.

Are there any side-effects from vitamin D supplements?

It is very unusual to get side effects from vitamin D if taken in the prescribed dose. However, very high doses can raise calcium levels in the blood. This would cause symptoms such as thirst, passing a lot of urine, nausea or vomiting, dizziness and headaches. If you have these symptoms, you should see your GP promptly, so that your calcium level can be checked with a blood test. Some guidelines advise that people taking high vitamin D doses should have their calcium levels checked during the first few weeks. In practice, this is not usually done unless you develop symptoms of a high blood calcium level.

What is the prognosis (outlook)?

The outlook is usually excellent. Both the vitamin levels and the symptoms generally respond well to treatment. However, it can take time (months) for bones to recover and symptoms such as pain to get better or improve.

The complications of severe deficiency have been mentioned. **Rickets** can occur in children, and **osteomalacia** in adults. These diseases affect the strength and appearance of bones, and can lead to permanent bone deformities if untreated or if treatment is delayed.

Vitamin D has been linked to other diseases. In recent years there have been associations with conditions such as cancer, heart disease, infectious disorders, autoimmune disease and diabetes. This does not mean that all people with vitamin D deficiency will get these problems. Nor does it mean that if you have one of these illnesses, a vitamin D deficiency is the cause. In these cases, vitamin D is thought to be just one factor.

Follow-up

Most people who are treated for vitamin D deficiency will need to be reviewed three months after starting treatment - depending on how severe their symptoms are. A further review after one year is advised.