Vitamin D Deficiency

Vitamin D deficiency is a very common problem - more than half of the UK population has insufficient levels of vitamin D. Vitamin D is mostly made in the skin by exposure to sunlight. Most foods contain very little vitamin D naturally, though some are fortified (enriched) with added vitamin D. Vitamin D is important for good health, growth and strong bones. Some people are more at risk of deficiency, in particular pregnant women, breast-fed babies and people with black or Asian skin types. Vitamin D supplements can be used in these groups to prevent vitamin D deficiency.

What is vitamin D?

Vitamins are a group of chemicals that are needed by the body for good health. Vitamin D is a fat-soluble vitamin. The fact that it dissolves in fat is important, because it means the body can store it for future use. Unlike other vitamins, we do not need to get vitamin D from the food that we eat. This is a good thing because most foods contain very little vitamin D naturally. Foods that contain vitamin D include:

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

Our main source of vitamin D is that made by our own bodies. 90% of our vitamin D is made in the skin with the help of sunlight.

UVB sunlight rays convert cholesterol in the skin into vitamin D. Darker skins need more sun to get the same amount of vitamin D as a fair-skinned person. The sunlight needed has to fall directly on to bare skin (through a window is not enough). 2-3 exposures of sunlight per week in the summer months (April to September) are enough to achieve healthy vitamin D levels that last through the year. Each episode should be 20-30 minutes to bare arms and face. This is not the same as suntanning; the skin simply needs to be exposed to sun*light*. The sun's rays can be damaging and sunburn should be avoided at all costs (mainly because it can increase your risk of skin cancer).

Chemical processes occur in the liver, and then the kidney, to produce calcitriol which is the active form of vitamin D. Calcitriol is a chemical that helps calcium and phosphorus to be absorbed from the gut. The calcium and phosphorus are essential for the structure and strength of our bones.

So, vitamin D is really important for strong bones. In addition, vitamin D seems to be important for muscles and general health. Scientists have also found that vitamin D may help prevent other diseases such as cancer, diabetes and heart disease.

What is vitamin D deficiency?

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

- The body has an increased need for vitamin D.
- The body is unable to make enough vitamin D.
- Not enough vitamin D is being taken in the diet.

Who gets vitamin D deficiency?

(1) 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 full-term pregnancies with short gaps between them. 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) Situations where the body is unable to make enough vitamin D

People who get very little sunlight on their skin are also at risk of vitamin D deficiency. This is more of a problem in the most northern parts of the world where there is less sun. This might occur in the following groups of people:

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 conservative Muslim veils such as the niqab or burqa.

People with pigmented (coloured) skins. This includes black and Asian people. Caucasian (white) people are less at risk.

Strict sunscreen use can potentially lead to vitamin D deficiency, particularly if high 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. 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. Vitamin D

deficiency can also occur in people taking certain medicines - examples include: carbamazepine, phenytoin, primidone, barbiturates and some HIV medicines - highly active antiretroviral treatment (HAART).

(3) Not enough dietary vitamin D

Vitamin D deficiency can occur in people who follow a strict vegetarian or vegan diet, or other 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 the adult population in the UK has insufficient levels of 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 of South Asian origin may be vitamin D-deficient. Most affected people don't have any symptoms 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 aches. It is because symptoms of vitamin D deficiency are very nonspecific in many people, hence the problem is often missed. The diagnosis is more easily reached in severe deficiencies with some of the classical (typical) 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 in the infant.

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Children with severe deficiency may have soft skull or leg bones. Their legs may look curved (bow-legged). This condition is known as rickets. (See separate leaflet called *'Rickets'* for more information).

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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.

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Children with vitamin D deficiency are more prone to infections and respiratory (breathing) symptoms can occur In severe cases, breathing is affected because of weak chest muscles and a soft ribcage.

Rarely an extremely low vitamin D level can cause weakness of the heart muscle (cardiomyopathy). This can affect the ability of the heart to pump

blood efficiently around the body and is known as heart failure. (Note: heart failure means the heart does not pump well, it is different to cardiac arrest where the heart stops beating completely).

Symptoms in adults

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Muscle pains or muscle weakness are the common symptoms. In more severe deficiency, this may cause difficulty standing up or climbing stairs, or can lead to the person walking with a 'waddling' pattern. This is known as osteomalacia. (See separate leaflet called *'osteomalacia'* for more information).

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Bone pains may develop and are typically felt in the ribs, hips, pelvis, thighs and feet.

How is vitamin D deficiency diagnosed?

It may be suspected from your medical history, symptoms, or lifestyle (so-called risk factors). A simple blood test for vitamin D levels can make the diagnosis. The blood test measures the level of a chemical called 25 hydroxy-vitamin D (also called 25(OH)D). This is the chemical formed in the liver during the process that converts sunlight into vitamin D.□□A normal level of vitamin D is above 50 nmol/L. Levels less than 25 nmol/L mean that you are deficient. A level in between means you probably don't have enough vitamin D in the body.□□Blood tests for calcium and phosphate levels and liver function may show changes linked to a low level of vitamin D. Your blood count might be checked as iron deficiency anaemia is often linked to rickets in children. 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.□□Extra tests may be needed if the cause of the deficiency is in doubt, or if there are other vitamin or mineral deficiencies. The doctors have to remember that there are lots of causes of vitamin D deficiency, and that underlying illnesses might be responsible.

What is the treatment for vitamin D deficiency?

Note: if you are pregnant or breastfeeding, see relevant section.□□

The treatment is to take vitamin D supplements. This is a form of vitamin D called ergocalciferol or calciferol. (The dose of ergocalciferol is written in units known as international units or IU. Some people use micrograms or µg instead, which are not the same as units.)□□Vitamin D can be given as an injection or as a medicine (liquid or tablets).

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.

Standard dose tablets, powders or liquids

These need to be taken every day for about 12 months in order 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. A disadvantage is that all these preparations contain either calcium or other vitamins, giving them a strong taste which some people dislike. Cod liver oil is an alternative.

Doses of vitamin D required

Proven vitamin D deficiency

Vitamin D deficiency in adults is treated with 10 000 IU calciferol daily or 60 000 IU weekly for 8-12 weeks. Alternatively, 300 000 IU to 600 000 IU can be given orally or by injection, once or twice. □□Treatment of vitamin D deficiency in children depends on the child's age. Under six months, 3000 IU calciferol per day is used for 8-12 weeks. In children over six months, 6000 IU is used daily, for the same length of time. In children over one year, 300 000 IU tends to be given as a single one-off dose.□

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 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). Adults need 1000-2000 IU calciferol daily or 10 000 IU weekly, for maintenance. Children under six months need 200-400 IU per day and over six months they need 400-800 IU per day.

Prevention

Adults need 400 IU per day. For people who get little sunshine, and in the elderly, this should be doubled to 800 IU. Higher preventative doses may be needed if you suffer from other conditions, such as kidney or liver disease. Equally, if you are taking some of the medicines that may affect the way the body handles vitamin D, higher doses may be required. Cod liver oil is a well-known supplement that contains good doses of vitamin D and so can be used to prevent deficiencies. Cod liver oil should not be used by pregnant women, due to the levels of vitamin A it contains.

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 hormone 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 are: 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.

If you are pregnant or breast-feeding

Vitamin D is especially important for pregnant or breast-feeding women, and their babies, because it is needed for growth.

<u>Prevention</u>
Vitamin D supplements are recommended for all pregnant women, breast-feeding women and breast-fed babies.

Pregnant women and breast-feeding mothers: 400 units (10 micrograms) daily of vitamin D are recommended. This can be either as a calcium/vitamin D tablet, or as a multivitamin tablet labelled as suitable for use in pregnancy. Some experts think that women who get no sunshine need a higher preventative dose such as 800 units (20 micrograms) daily. Pregnant women can get free prescriptions and vitamins.

Babies: all breast-fed babies should be given vitamin drops (Abidec®, Dalivit® or Healthy Start Children's Vitamin Drops in the dose advised on the label). Babies under one year need 200 IU of vitamin D per day. Over one year then need between 280 and 400 IU per day. Free vitamins are available (for those that qualify) with the Healthy Start scheme. Bottle-fed babies do not need vitamin D supplements as formula milk is fortified with vitamin D. All weaned babies who take cow's milk need vitamin D supplements as it contains little natural vitamin D. Outside the UK, some countries do add vitamin D to cow's milk, to fortify it.

<u>Treatment of proven vitamin D deficiency in pregnancy</u>

Doses of up to 1000 units (25 micrograms) daily of vitamin D can be used. (In some situations, higher doses have been used to treat pregnant women.) □

Cautions with vitamin supplementation in pregnancy

If you are pregnant or breast-feeding you should not use high doses of vitamin D (the injections and high-dose tablets/liquids described above). This is because of uncertainty about whether these doses are too high for the baby. Doctors tend to be cautious about the dose of vitamin D given to pregnant or breast-feeding women, and will often limit the dose to 1000 units daily. This is a safe dose. It is likely that higher doses are safe for pregnant women but further guidance is awaited. □□If you are pregnant, you should not take supplements containing large amounts of vitamin A (due to risk of harm to the unborn baby). Supplements labelled as suitable for pregnancy are safe to use. Similarly, pregnant women are advised not to eat liver due to the high levels of vitamin A. Vitamin A is, however, safe if you are breast-feeding.

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 have symptoms of high calcium as described above.

Prognosis (outlook) in vitamin D deficiency?

The outlook for vitamin D deficiency 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.□□Mild or short-lived deficiency usually causes few or no symptoms. Any symptoms that do occur improve and generally disappear with treatment.□□The complications of severe deficiency have already been mentioned. Rickets can occur in children, and osteomalacia in adults. (See separate leaflets called *Rickets'* and *'Osteomalacia'* for more information). These diseases affect the strength and appearance of bones, and can lead to permanent bone deformities if untreated or if treatment is very delayed.□□Vitamin D is increasingly being linked to other diseases and illnesses. In recent years there have been associations with non-musculoskeletal (ie, non- bone or non-muscle) 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, neither 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 a factor. Since treatment is relatively straightforward, it is a very worthwhile undertaking, because of the numerous potential health benefits.

Follow-up

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

A useful source of information

Healthy Start scheme
Web: www.healthystart.nhs.uk A government-run scheme that replaces the welfare food scheme. With Healthy Start, you can get free vouchers every week which you swap for milk, fresh fruit, fresh vegetables and infant formula milk. You can also get free vitamins. You could qualify if you receive benefits (Jobseeker's Allowance, Income Support or receive Child Tax Credit) or if you are pregnant and aged under 18.

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