



## **Osteomalacia (soft bones)**

This booklet provides information and answers to your questions about this condition.

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# What is osteomalacia (soft bones)?



Osteomalacia is a condition which affects the skeleton. It's often, but not always, caused by a lack of vitamin D. It most commonly affects the elderly and/or people from some areas of Asia. In this booklet we'll explain what osteomalacia is, what causes it and what treatments are available. We'll also tell you where to find more information.

At the back of this booklet you'll find a brief glossary of medical words – we've underlined these when they're first used.

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# At a glance

## Osteomalacia

### What is osteomalacia?

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Osteomalacia, or soft bones, usually develops because of a lack of vitamin D. It can cause bone pain, muscle weakness and broken bones. A similar condition occurs in children called rickets. Rickets has different symptoms to osteomalacia because the lack of vitamin D affects the growing skeleton differently to the adult skeleton.

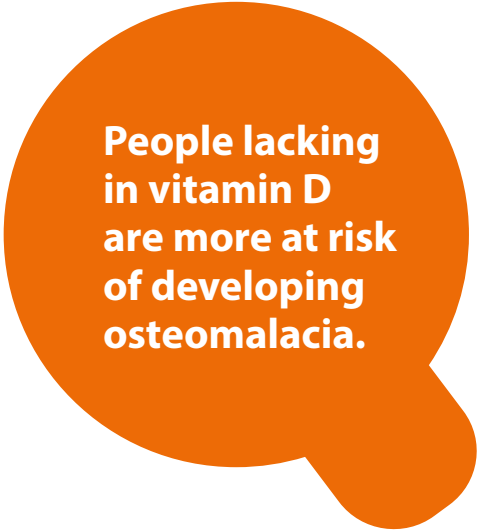
### What are the symptoms?

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Symptoms include:

- **pain felt in the bones**, usually in the legs, groin, knees and feet – sometimes a minor knock to a bone will feel more painful than normal.
- **muscle weakness**, which usually affects the thighs, shoulders and main trunk of the body.
- **pain caused by slight cracks in the bone (partial fractures)** – sometimes these cracks can turn into complete breaks (complete fractures).

As the condition gets worse, pain can be felt in every bone and simple movements can be painful.



People lacking in vitamin D are more at risk of developing osteomalacia.

### Who gets it?

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Anyone who's lacking in vitamin D is at risk of developing osteomalacia. The people most at risk are:

- **those who are unable to produce enough vitamin D through exposure to sunlight**, for example because they're too ill, frail or have no exposure because they keep their skin covered.
- **those whose diet is lacking in vitamin D and/or calcium.**

Some people from Asia, particularly the Indian sub-continent and surrounding region, are particularly at risk of developing osteomalacia, but we don't yet know why this is.

A lack of vitamin D can also occasionally occur as part of an underlying disease, such as coeliac disease.

### What causes it?

Bone is a living, active tissue that's continually being removed and replaced. When normal bone is formed, the soft inner mesh of bone is coated by mainly calcium and phosphorus. Vitamin D is needed for this process to occur. A lack of vitamin D, calcium or phosphorus means that this process doesn't take place normally and, as a result, weak, soft bones are created. This is osteomalacia.

### What treatments are there?

Treatment will cure osteomalacia in most cases, but easing bone pain and muscle weakness may take several months:

- **Vitamin D tablets or capsules** can be taken if you don't get enough exposure to sunlight.
- **Calcium supplements** can be taken if you don't get enough from your diet.
- **Painkillers** may be needed while bone fractures heal.

### How can I help myself?

The following might help:

- **Exercise** helps to strengthen bones – anything that involves walking or running is very useful.
- A diet that includes enough vitamin D and calcium can help to prevent the condition.
- Where possible, going outside and exposing your arms and face to sunshine (without sunscreen) will help to increase your vitamin D level.



## What is osteomalacia?

Osteomalacia means soft bones. Bone is a living, active tissue that's continually being removed and replaced. This process is known as bone turnover. Bone consists of a hard outer shell (the cortex) made up of minerals, mainly calcium and phosphorus, and a softer inner mesh (the matrix) made up of collagen fibres (see Figure 1).

When normal bone is formed, these fibres are coated with mineral. This process is called mineralisation. The strength of the new bone depends on the amount of mineral covering the collagen matrix. The more mineral laid down, the stronger the bone.

Osteomalacia happens if mineralisation doesn't take place properly. In osteomalacia more and more bone is made up of collagen matrix without a mineral covering, so the bones become soft.

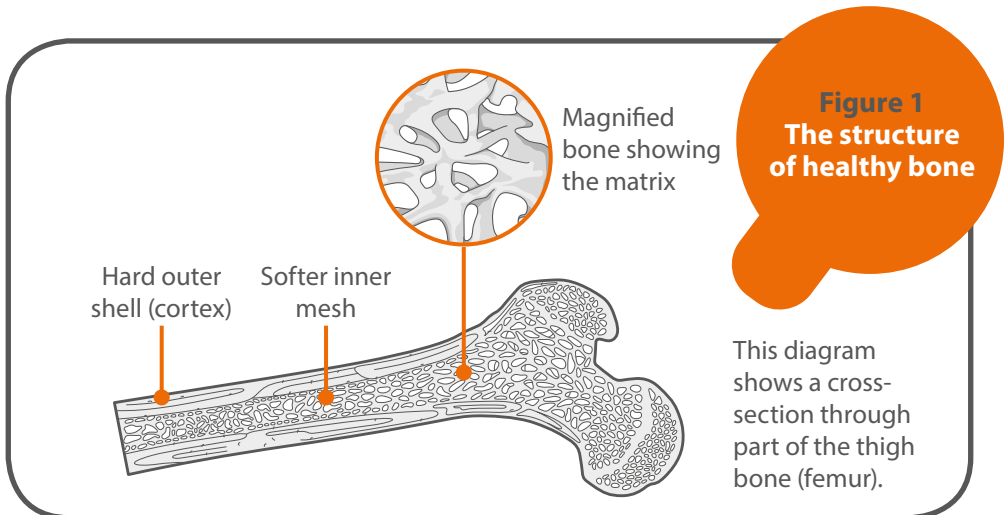
These softened bones may bend and crack, and this can be very painful.

There are rarer types of osteomalacia. These are usually due to problems in the kidneys which result in loss of phosphorus from the body. This is sometimes inherited and passed from parents to their children in their genes, but can also happen with other kidney problems and occasionally as a side effect of treatment with some drugs.

## What are the symptoms of osteomalacia?

Osteomalacia, particularly when caused by a lack of vitamin D, can result in:

- pain felt in the bones
- muscle weakness
- slight cracks in the bone (partial fractures).



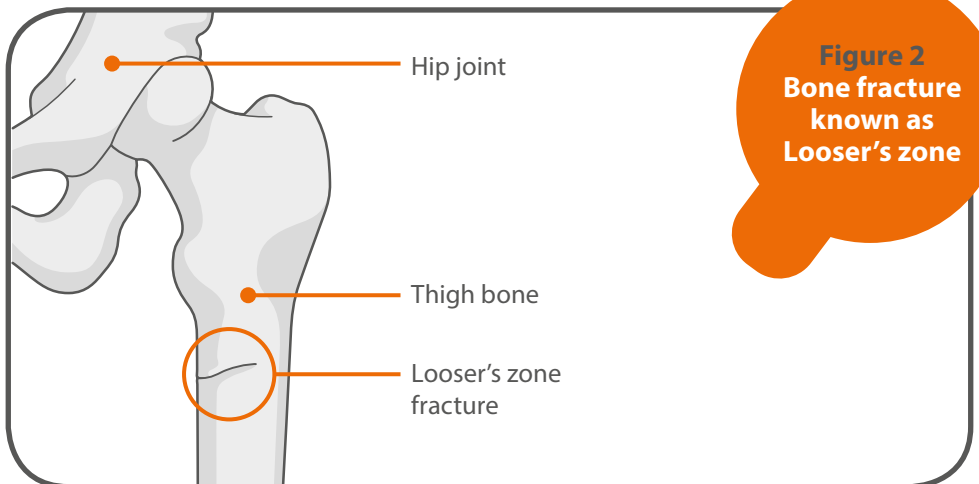
**Pain felt in the bones is the most common symptom of osteomalacia.**

Bone pain is felt most often in the legs, groin, upper thighs and knees, and sometimes in the feet when you stand, walk or run. Sitting or lying down to rest can often ease the pain. Sometimes a minor knock on a bone such as the shin will feel unusually painful. As the condition gets worse, pain can be felt everywhere and simple movements can hurt.

Muscles may become weak or feel stiff. The weakness tends to affect the thighs and the muscles in the shoulders and main trunk of the body. This can make it difficult to climb stairs, get up from a chair without using the arms for support and, in very severe cases, get out of bed.

Partial fractures linked with osteomalacia are called Looser's zones (see Figure 2), which can cause pain. Occasionally, these cracks can lead to full breaks (complete fractures).

In the much rarer inherited form of osteomalacia, muscle weakness is less common. The main problem is that mineral laid down in the ligaments and tendons around the spine, hips and shoulders makes it difficult to move these joints.



**Figure 2**  
**Bone fracture**  
**known as**  
**Looser's zone**

## Who gets osteomalacia?

Anyone who's lacking vitamin D is likely to develop osteomalacia. Although we can get vitamin D from foods, most of our supply of vitamin D is produced by the body itself. Cholesterol, which is present naturally in the skin, is converted to vitamin D through the action of sunlight on the skin.

The people most at risk of osteomalacia are those who aren't able to produce enough vitamin D through exposure to sunlight because:

- they're too frail or ill to go outside
- they wear clothing that covers almost all of their skin, for example, for religious reasons
- they have dark skin and live in parts of the world where the sunlight isn't very strong – dark skin is protective against intense sunlight but in cooler climates may be less efficient as a source of vitamin D.

**Cholesterol in the skin is converted to vitamin D through the action of sunlight on the skin.**

Some people from Asia, particularly from the Indian sub-continent and surrounding region, are particularly at risk of osteomalacia. We don't yet know why this is the case, but it's likely to be due to a combination of factors. The skin of people from this region doesn't absorb vitamin D as well in cooler climates, and women who wear clothes that cover all their skin for religious reasons (such as a burka) will expose their skin less to direct sunlight.

Some foods commonly used in Asian diets are poor in vitamin D, and there may be chemicals within the diet which prevent vitamin D absorption – for example it's thought that chapatti flour may prevent the normal absorption of calcium from the stomach, though some chapatti flours now have vitamin D added to help calcium absorption.

Many people from the Indian sub-continent and surrounding region are lactose intolerant, and so they may not be absorbing enough calcium.

People whose diet is lacking in vitamin D and/or calcium may be at risk, especially if they're also unable to produce enough vitamin D in their skin.

## What causes osteomalacia?

To allow bone mineralisation to take place the body needs enough minerals (calcium and phosphorus) and vitamin D. If the body doesn't have enough of any one of these, osteomalacia will develop.



However, not having enough calcium is very unusual as a cause of osteomalacia in Western countries. Certain rare disorders can cause normal kidneys to lose phosphorus, which causes osteomalacia, but the most common cause of the condition is a lack of vitamin D.

### Vitamin D deficiency

The amount of vitamin D can be expressed as micrograms (millionths of a gram, usually abbreviated to  $\mu\text{g}$ ) or units. 10  $\mu\text{g}$  is the same as 400 units and so 25  $\mu\text{g}$  is the same as 1,000 units.

The body needs roughly 10  $\mu\text{g}$ /400 units of vitamin D a day to protect itself from osteomalacia. The skin can produce up to 100  $\mu\text{g}$ /4,000 units a day in the summer, which can be stored in the body for a few weeks. A diet that provides an average of 10–20  $\mu\text{g}$ /400–800 units a day will help protect you from osteomalacia.

If you don't go out into the sun often, you'll need to eat plenty of oily fish or take supplements to get enough vitamin D.

**Figure 3: the amount of vitamin D supplements experts advise 'at risk' groups to have on a daily basis**

	$\mu\text{g}$ per day	Units per day
All pregnant and breastfeeding women	10 $\mu\text{g}$	400 units
Children aged six months to five years*	7-8.5 $\mu\text{g}$	280-340 units
People aged over 65 who don't get much sunlight	10 $\mu\text{g}$	400 units

\*Infants receiving 500ml of formula a day won't need supplements as these products are fortified with vitamin D. Breastfed infants may need vitamin D supplements from one month of age if their mother didn't have vitamin D supplements in pregnancy.



## Rarer causes of osteomalacia

Although a lack of vitamin D is the most common cause of osteomalacia, your doctor will need to check that it's not being caused by anything else. Rarer causes include:

- gut problems, for example untreated coeliac disease, or previous surgery on the stomach
- liver disease
- kidney failure
- epilepsy tablets.

If any of the above applies to you, you may need additional protection against osteomalacia. It's important to talk to your doctor about this.

## What is the outlook?

The outlook is very good, as most people with osteomalacia will recover with treatment. However, it can take months for bones to recover and for muscles to become strong again.

A late diagnosis can make recovery more difficult, especially if bones have fractured.

## How is osteomalacia diagnosed?

Because the symptoms of osteomalacia are often not very specific, it can be some time before the condition is diagnosed. Your doctor may ask about your diet and any family history of bone disorders. It's common for people to have osteomalacia for two or three years before it's diagnosed.

## What tests are there?

A simple blood test is all that's needed to make the diagnosis – the levels of calcium, phosphorus and vitamin D are easily measured. Blood tests for the following also help to make the diagnosis:

- Alkaline phosphatase, an enzyme produced by osteoblasts (bone-producing cells), is at a raised level in osteomalacia.
- Parathyroid hormone, produced by the parathyroid gland, is raised as part of the body's reaction to the condition.



Blood tests will be able to rule out some of the rarer causes of the condition, while an x-ray may show any cracks or fractures in the bones.

## What treatments are there for osteomalacia?

Treatment will cure osteomalacia in most cases, but easing bone pain and muscle weakness may take several months.

If the disease is caused by a lack of vitamin D, daily doses of 20–50µg/800–2,000 units vitamin D are often used, but some doctors may give larger doses to start off with. Calcium supplements of 500–1,000 milligrams (mg) a day may speed up bone healing if your calcium intake from your normal diet is below 750 mg a day.

You'll usually need daily supplements of vitamin D over a long period of time if there isn't an obvious, curable cause for your osteomalacia. If you stop taking vitamin D, the condition may return.

Once you begin treatment for the condition any cracks in your bones will heal normally, though you may need painkillers in the meantime. You should avoid intensive exercise until the cracks have healed.

People with kidney failure or inherited forms of osteomalacia often need lifelong support from their doctor. They'll need to be monitored regularly in a hospital-based specialist unit. They usually need special forms of vitamin D such as calcitriol tablets. This is because the kidney

normally converts ordinary vitamin D to calcitriol, which is the form of the vitamin needed for bone mineralisation.

## Self-help and daily living

There are many things people can do to promote healthy bones. These include:

- having a diet rich in vitamin D
- getting a healthy amount of sunshine
- reducing alcohol intake
- stopping smoking
- exercising regularly
- maintaining a healthy weight.

### Exercise

Exercise helps to strengthen the bones, especially weight-bearing exercise (anything that involves walking, running or lifting weights). However, you should avoid intensive exercise while any fractures or cracks in the bones are healing.

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**i See Arthritis Research UK booklet**  
*Keep moving.*

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### Sunlight

Where possible, going outside and exposing your arms and face to sunlight is the best way to get vitamin D. From June to August just 15 minutes a day is generally enough. Don't allow your skin to go red and take care not to burn, particularly in strong sunshine and if you have fair or sensitive skin.

## Diet and nutrition

A diet that includes vitamin D and calcium can help, but this won't prevent the condition by itself. Nevertheless, a diet that provides vitamin D is especially important for those who don't get enough exposure to sunlight.

Oily fish such as mackerel, salmon and herring are the best dietary sources of vitamin D, while dairy products are the best sources of calcium. A dietitian will be able to advise you if you're unable to get calcium and vitamin D from these sources. However, certain groups of people are advised to take supplements, including the elderly, pregnant or breastfeeding women, and people who don't have much exposure to sunlight (see figure 3).

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**i See Arthritis Research UK booklets**  
*Complementary and alternative medicine for arthritis; Diet and arthritis.*

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**Oily fish such as mackerel, salmon and herring are the best dietary sources of vitamin D.**

## Research and new developments

There are different forms of vitamin D – vitamin D2 comes from plants but vitamin D3 is provided by eating fish and eggs, or exposure to sunlight. In general, vitamins D2 and D3 have been considered as good as each other, although some small new studies have suggested that vitamin D3 is actually more effective.

A recent review suggested that there's no difference between the effectiveness of vitamin D2 or D3 when taken as a tablet. At the moment, the vitamin D provided in multivitamin tablets can be either vitamin D2 or D3, but many companies are now moving towards using vitamin D3.

Low levels of vitamin D are very common in the population of north European countries. In winter, as many as one in eight people in the UK may have deficient levels of vitamin D in their blood (although very few people get osteomalacia), and slightly reduced levels are present in many more people. Low levels of vitamin D have been associated with many diseases, but it is unclear if taking vitamin D supplements helps to prevent or treat these diseases. Research is taking place to try to find out whether there are wider benefits to taking vitamin D supplements.

## Glossary

**Casein allergy** – an allergy to a protein found in milk and other dairy products. It can cause swollen lips, mouth and face, a rash and sneezing.

## Arthritis Research UK

### Osteomalacia

**Cholesterol** – a type of fat called a lipid which is important for cell structure. A certain level of cholesterol is needed to stay healthy, but having too much in your blood stream can increase the risk of strokes and heart attacks.

**Coeliac disease** – a common digestive condition that causes a bad reaction to gluten, a protein found in wheat, barley and rye. Symptoms include bloating, wind and diarrhoea.

**Collagen** – the main substance in the white, fibrous connective tissue which is found in tendons, ligaments and cartilage. This very important protein is also found in skin and bone.

**Lactose intolerance** – a common digestive problem where the body is unable to digest a type of sugar mainly found in milk and dairy products (lactose). It can cause bloating, wind and diarrhoea.

**Ligament** – a tough, fibrous band that anchors the bones on either side of a joint and holds the joint together.

**Tendon** – a strong, fibrous band or cord that anchors muscle to bone.

## Where can I find out more?

If you've found this information useful you might be interested in these other titles from our range:

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- *Osteoporosis*
- *What is arthritis?*

### Therapies

- *Meet the rheumatology team*

### Self-help and daily living

- *Complementary and alternative medicine for arthritis*
- *Diet and arthritis*
- *Keep moving*
- *Pain and arthritis*

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### Arthritis Research UK

Copeman House  
St Mary's Court  
St Mary's Gate, Chesterfield  
Derbyshire S41 7TD  
Phone: 0300 790 0400  
[www.arthritisresearchuk.org](http://www.arthritisresearchuk.org)

### Related organisations

The following organisations may be able to provide additional advice and information:

### Arthritis Care

Floor 4, Linen Court  
10 East Road  
London N1 6AD  
Phone: 020 7380 6500  
Helpline: 0808 800 4050  
Email: [info@arthritiscare.org.uk](mailto:info@arthritiscare.org.uk)  
[www.arthritiscare.org.uk](http://www.arthritiscare.org.uk)

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## We're here to help

Arthritis Research UK is the charity leading the fight against arthritis.

We fund scientific and medical research into all types of arthritis and musculoskeletal conditions.

We're working to take the pain away for sufferers with all forms of arthritis and helping people to remain active. We'll do this by funding high-quality research, providing information and campaigning.

Everything we do is underpinned by research.

We publish over 60 information booklets which help people affected by arthritis to understand more about the condition, its treatment, therapies and how to help themselves.

We also produce a range of separate leaflets on many of the drugs used for arthritis and related conditions. We recommend that you read the relevant leaflet for more detailed information about your medication.

Please also let us know if you'd like to receive an email alert for our quarterly online magazine, *Arthritis Today*, which keeps you up to date with current research and education news, highlighting key projects that we're funding and giving insight into the latest treatment and self-help available.

We often feature case studies and have regular columns for questions and answers, as well as readers' hints and tips for managing arthritis.

### Tell us what you think of our booklet

Please send your views to:

**bookletfeedback@  
arthritisresearchuk.org**

or write to us at:

Arthritis Research UK, Copeman House, St Mary's Court, St Mary's Gate, Chesterfield, Derbyshire S41 7TD

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## Get involved

You can help to take the pain away from millions of people in the UK by:

- volunteering
- supporting our campaigns
- taking part in a fundraising event
- making a donation
- asking your company to support us
- buying products from our online and high-street shops.

To get more **actively involved**, please call us on **0300 790 0400**, email us at **[enquiries@arthritisresearchuk.org](mailto:enquiries@arthritisresearchuk.org)** or go to **[www.arthritisresearchuk.org](http://www.arthritisresearchuk.org)**



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**[www.arthritisresearchuk.org](http://www.arthritisresearchuk.org)**

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Published January 2016 2058/OM/16-1

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