- Minerals in the body / Minerals in human nutrition

SCIENCE

VITAMIN BALANCE



Can a lack or excess of key vitamins and minerals really cause so much damage to our bodies?

WORDS DR JOANNA ELPHICK

If it's cold outside we all know to put on a coat to keep warm, but there's so much more that we can do to remain healthy, just by watching what we eat. A well-balanced selection of micronutrients can contribute to the body's natural defences by reinforcing its physical barriers, such as the mucus linings and the skin. Micronutrients is the collective term for a wide range of vitamins and minerals that are essential for our bodies to function properly. Vitamins are organic substances, meaning they are produced by plants or other animals, and can be broken down into two distinct groups: fat-soluble and water-soluble vitamins. Vitamins A, D, E and K will dissolve in fat, which can then be stored in our bodies, hence the name 'fat-soluble' vitamins. The body can take what it needs as and when necessary.

Water-soluble vitamins, on the other hand, will dissolve in water, and therefore can't be stored for use later. Water-soluble vitamins that the body doesn't need straight away, such as C or any of the B-complex groups, are flushed through the bloodstream and lost when you next need the toilet. Because they can't be retained for later use, the body needs to replenish water-soluble vitamins every day. Micronutrients also include minerals such as zinc, which are inorganic substances that can be found in water or in the soil. When we plant seeds, the growing plants absorb the minerals from the soil and rain. When ripe and ready, we harvest the plants to eat, taking in the minerals at the same time. Other minerals are ingested when we eat animals that have previously nibbled on plants growing in the soil. A healthy diet should ensure that we have a perfect balance of vitamins and minerals – but how much is enough, and can we ever overdo it?

The recommended dietary intake is different for each vitamin and mineral. It also



DID YOU KNOW? Vitamin A is used to treat chronic acne – although too much vitamin A is extremely toxic

Did you know?
Vitamin C won't stop you from catching a cold

depends on the age, gender and general health of the individual. Women tend to need less vitamin quantities than men, although pregnant women and those breastfeeding require more. People who smoke need a higher dose of most micronutrients than those who don't smoke. Our bodies tend to need lower doses of minerals, referred to as 'trace' levels.

Of course, you can have too much of a good thing. For many vitamins, an overdose can be as unpleasant as a deficiency. This is known as hypervitaminosis and can be an extremely distressing experience. Excessive bleeding, diarrhoea, depression and blurred vision are just a few of the symptoms of overdosing. In some extreme circumstances it can even be fatal. However, vitamin K is an exception. This particular wonder vitamin has no maximum intake level since the body can take any amount you give it – that means you can never have too much broccoli or prunes.

RICKETS THROUGH THE AGES

As early as the first century CE, Greek physicians were identifying bone deformities in children, but it wasn't until the 17th century that the disease was formally recognised. During the Industrial Revolution, many children suffered from rickets due to their unhealthy lifestyles. Youngsters, forced to spend their days in dark factories or in coal mines, were kept out of the sunlight. By the 19th century, the affliction was widespread throughout Europe. However, by the early 20th century, doctors realised both diet and sunshine played a vital role in avoiding the disease. In 1923, Harry Steenbock showed irradiation by ultraviolet light increased the vitamin D content in food, and the process was soon applied to milk given to children, thereby reducing the disease.



Rickets causes the bones to soften, which often leads to bow legs

250,000
A quarter of a million children with vitamin A deficiency go blind every year

GUT BACTERIA MAKE TEN PER CENT OF OUR BODIES' VITAMIN K REQUIREMENTS

90%
Most of your vitamin D intake comes from Sun exposure

FIVE YEARS
The liver can store B12 for half a decade

93 MILLIGRAMS
The amount of vitamin C found in 100 grams of kiwifruit

APPROXIMATELY 1 BILLION PEOPLE WORLDWIDE HAVE A VITAMIN D DEFICIENCY

£461 MILLION
Half a billion pounds worth of vitamins were sold in the UK in 2022

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WHAT MICRONUTRIENTS DO WE NEED?

A vast array of vitamins and minerals are needed to keep the body functioning properly

DEFICIENCY HYPERVITAMINOSIS



1 VITAMIN K

Vitamin K keeps bones strong as it produces osteocalcin, which makes healthy bone tissue. It helps wounds heal and may improve your eyesight. A deficiency could lead to excessive bleeding and fragile bones. There are no known effects of vitaminosis.

Did you know?

Vegans are particularly at risk from vitamin deficiency



6 POTASSIUM

Potassium supports the heart muscles, ensuring that they function properly. It also regulates the fluids within the body. A deficiency can cause an abnormal heart rhythm and fatigue. Too much potassium is particularly harmful for the stomach, causing cramps and sickness.



7 VITAMIN A

Although vitamin A is extremely important for your eyesight, skin, teeth, cell maintenance, immune system and bones, too much can be very dangerous indeed. Early Arctic explorers suffered horrific symptoms, including hair loss, gastrointestinal issues, neurological problems and even found their skin started to peel off after eating polar bear livers – high in vitamin A, or more specifically retinol. As a result, today's doctors are quick to warn against an overdose. A deficiency is common in developing countries and can cause childhood blindness. Less severe symptoms include itchy skin, brittle nails and a dry mouth.



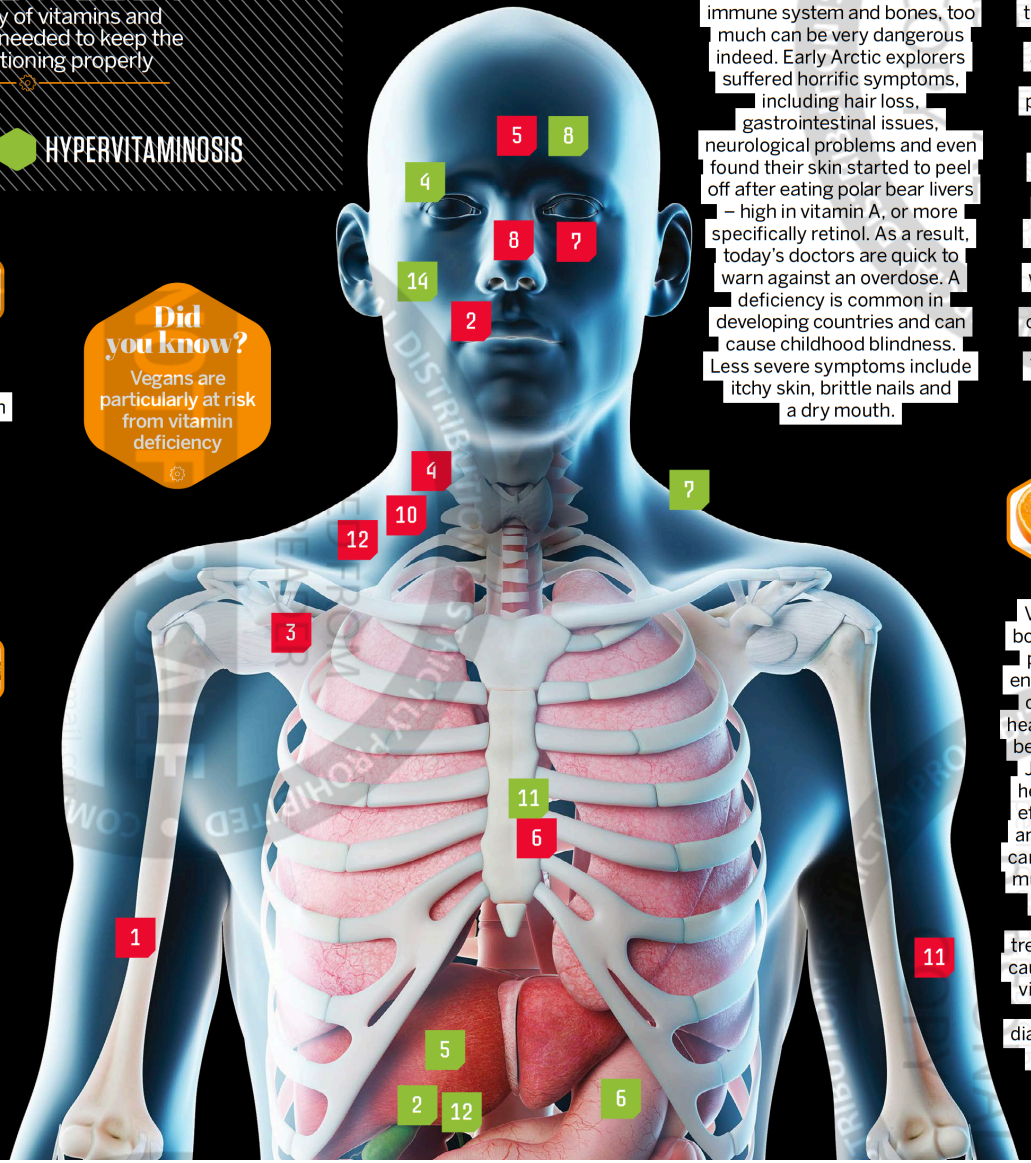
3 VITAMIN D

Vitamin D helps support healthy bones, teeth and muscles as it is involved in the regulation of calcium and phosphate in the body. It also reinforces our immune system. In winter, many people suffer from vitamin D deficiency, which causes rickets in children and a painful condition known as osteomalacia in adults whereby the bones throb. Hypervitaminosis is equally concerning when dealing with vitamin D as it can lead to hypercalcaemia, which causes an unwanted buildup of calcium in the body. This in turn causes damage to the skeleton and can even harm the kidneys.



2 VITAMIN C

Vitamin C helps maintain the body's epithelial barriers, which prevent external toxins from entering our system. It supports cell structure and keeps skin healthy. Bones and cartilage also benefit from this super vitamin. Just like vitamin K, vitamin C helps wounds heal quickly and effectively. It is also a powerful antioxidant. Too little vitamin C can lead to scurvy, which causes muscle weakness, bleeding and inflamed gums and severe anaemia. If scurvy is not treated immediately, it can even cause death. However, too much vitamin C can also be harmful, leading to stomach pain, diarrhoea and an increase in the likelihood of kidney stones.



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DID YOU KNOW? Phosphorus is needed to build strong, healthy bones, but ingesting too much can cause the bones to fracture

5 VITAMIN B COMPLEX
There are eight micronutrients in the B complex that support many metabolic and regulatory tasks within our bodies. A deficiency can cause fatigue, poor memory, depression and constipation. Hypervitaminosis can lead to liver damage, diabetes, blindness, acne and leukaemia.

4 VITAMIN E
The 'vitamin of youth' is an antioxidant, clearing our bodies of unwanted toxins and protecting the heart by decreasing blood pressure. Too little can cause anaemia, eye diseases and nerve damage. Hypervitaminosis is equally dangerous, causing blurred vision and fatigue.

"In some extreme circumstances it can even be fatal"

8 ZINC
This micronutrient is vital for growth, production of white blood cells and for a healthy reproductive system. A deficiency can lead to loss of appetite, rashes and loss of smell. Too much zinc can instigate headaches, dizziness and nausea.

9 CALCIUM
Calcium ensures our bones and teeth stay strong and supports the functioning of our muscles. Too little can lead to rickets or osteoporosis. Too much can lead to an upset stomach.

10 IRON
Iron helps make important red blood cells which carry oxygen around the body. A deficiency can lead to anaemia and fatigue, while too much can cause sickness and constipation.

11 SODIUM CHLORIDE
Salt helps the body digest food and keep fluid levels balanced. The body only needs a very small amount to stay healthy. Too little can cause muscle cramps. Too much is dangerous and can instigate a heart attack.

12 COPPER
Copper is vital for healthy blood and is also important in infant development. A deficiency can impede the release of iron which stops the production of haemoglobin. Too much can cause sickness and damage to the liver and kidneys.

13 MAGNESIUM
Magnesium helps turn food into energy. It also supports the parathyroid gland. Too much magnesium can cause diarrhoea. Too little can lead to tremors, poor coordination and even seizures.

14 SELENIUM
Selenium helps support the body's immune system and reproductive system. An overdose causes selenosis, where hair and nails fall out. A deficiency can lead to muscle weakness and fatigue. Patients are often depressed.

Our bodies make vitamin D when exposed to the Sun

Swedish explorer Salomon August Andrée hunted polar bears for food during his 1897 expedition of the Arctic

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