

understanding
Nutrition



understanding
Health

*a series of booklets to
help you with common
health problems*

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Understanding Nutrition and Health

Introduction

To be healthy we need to eat

food that contains the right amounts of vitamins and minerals on a daily basis. The amount we need of these micro-nutrients changes at different times in our lives. If we are ill for any reason we may need extra supplies.

What are vitamins and minerals?

Vitamins are naturally occurring substances that we must have if our bodies are to function properly. In particular they are needed for chemical reactions such as changing food into energy. Most cannot be made by the body so another source has to be found.

There are two kinds of vitamins.

Fat-soluble vitamins (A, D, E and K) are absorbed with fats from



the intestine into the bloodstream. They are stored in fatty tissue, especially in the liver.

Water-soluble vitamins (B and C) cannot be stored (except vitamin B12). These vitamins are needed daily.

To make sure of a good intake of these vitamins, fruit and vegetables should be stored in a cool, dark place and eaten fresh, raw or lightly cooked.

Minerals are also necessary for a healthy life. At least thirteen are needed and they take part in all the

body's activities. Some of the most important minerals are:

Iron is found in foods such as red meat, eggs, spinach and broccoli. It is essential for the production of red blood cells.

Zinc is found in seafoods (especially oysters), meat, liver, eggs, cheese. It is essential for growth and development, a healthy immune system, and for the functioning of many enzymes in our body.

Selenium is found in oil, fish, shellfish, wholemeal bread and wholegrains. It is important in maintaining a healthy liver.

Calcium is found in milk, cheese, yoghurt, tinned sardines, green

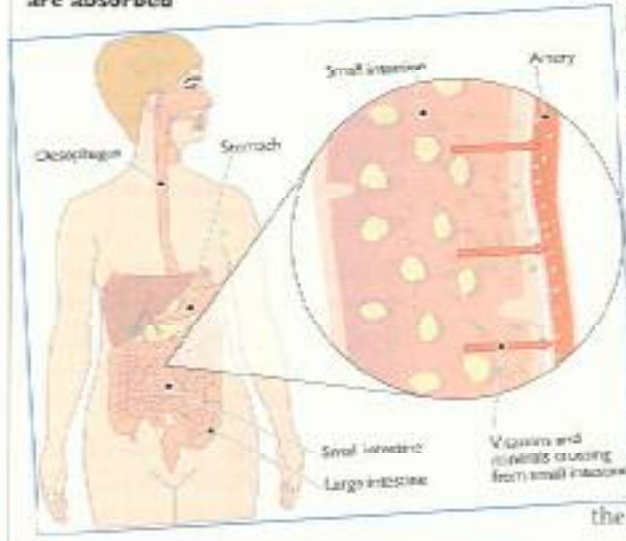
leafy vegetables, and is essential for strong healthy bones.

Other minerals include copper, manganese, molybdenum, chromium, iodine, potassium, phosphorus, magnesium and sodium.

How are vitamins and minerals absorbed?

After food has been chewed it passes down the oesophagus (or gullet) into the stomach. Here it can spend up to five hours while acid and enzymes break it down into its different parts. But little absorption takes place – only 10-15 per cent of protein, 30-50 per cent of carbohydrate and hardly any fat.

How vitamins and minerals are absorbed



Most absorption takes place in the next part of the digestive tract – the small intestine. The small intestine is a much coiled tube over twenty feet long. Here vitamins and minerals pass through the wall of the intestine into the blood stream.

Blood carries them all over the body to wherever they are needed. The intestine is full of 'friendly' bacteria which help absorption and also make certain vitamins such as vitamin K. Antibiotics can kill these bacteria and it can take months for them to re-establish themselves.

Some medicines may affect the absorption of vitamins and minerals. Antibiotics, some antacids and anti-epileptic medicines are the best known examples.

How vitamins, minerals and trace elements affect the immune system

The immune system protects the body against infection from bacteria, viruses and fungi. It also plays an important part in preventing cancer. It is made up of physical and chemical barriers such as the skin, mucous membranes and stomach acid, as well as antibodies and white blood cells in the blood.

Vitamins, minerals and other nutrients are needed for a healthy immune system in addition to their



important role as antioxidants (see p.10). Research published in the Lancet (1992) showed that a daily multivitamin and multimineral supplement improved the immune system and reduced the risk of infections in people aged over 65.

For example, vitamin C strengthens the action of white blood cells which scavenge and destroy bacteria and viruses (such as cold and flu viruses). It is a powerful antioxidant too. It helps make collagen, which is needed for skin, gums and body tissues – the first barrier against infection.

Zinc is an antioxidant, and is also important for a healthy immune system as well as for the repair and renewal of skin cells.

Another example is the B vitamin, pantothenic acid, which helps make the antibodies needed to fight invading bacteria.

Vitamins

Fat-soluble vitamins

Vitamin	Where is it found?	What does it do?	Deficiency diseases and medical uses
VITAMIN A (also known as Retinol)	Milk, butter, cream, cheese, eggs, fish liver oils, liver, kidney. It also comes from beta-carotene, found in brightly coloured fruit and vegetables which is converted into vitamin A in the body.	It is important for healthy skin and hair and to help us see in dim light. It is also useful as an anti-oxidant.	Deficiency is rare.
VITAMIN D (also known as Calciferol)	Dry fish, milk, eggs, butter and fortified margarines. The best non-food source is sunlight on the skin.	Essential for the absorption of calcium and phosphorus which are needed to maintain strong bones and teeth.	Prevention and treatment of rickets.
VITAMIN E (Tocopherol)	Wheatgerm, almonds, peanuts, vegetable oils (especially unrefined sunflower and rapeseed), and green leafy vegetables.	Needed for muscle strength and hormones. But its most important use is as an anti-oxidant (see later).	Needed to prevent poor fat absorption in some young children.
VITAMIN K	Most vegetables, especially cauliflower and green leafy vegetables, and wholegrain cereals.	Essential for blood clotting.	Deficiency causes poor clotting and so is routinely given to new-born infants to prevent bleeding.



Water-soluble Vitamins

VITAMIN B

This is not one but a number of water-soluble vitamins which are often found in the same foods. The group includes vitamin B1 (also known as thiamin), B2 (riboflavin), nicotinic acid, B6 (pyridoxine), folic acid, B12 (cyanocobalamin), biotin and pantothenic acid.

Vitamin	Where is it found?	What does it do?	Deficiency diseases and medical uses
VITAMIN B1 (Thiamin)	Wholegrain cereals, brown rice, fortified breakfast cereals, milk, eggs.	Important for the release of energy from food. Essential for the nervous system.	Severe deficiency causes the illness beriberi.
VITAMIN B2 (Riboflavin)	Liver, fish, milk, eggs, fortified bread and cereals, green leafy vegetables such as broccoli.	Important for the release of energy from food. Helps maintain healthy skin, hair and the lining of organs such as the nose and throat.	Deficiency may cause cracks and sores on the mouth, lips and tongue.
VITAMIN B3 (Nicotinic acid)	Liver, fish, milk, eggs, fortified bread and cereals, green leafy vegetables.	Important for the release of energy from food. Essential for nervous and digestive systems.	Severe deficiency causes the illness pellagra.
VITAMIN B6 (Pyridoxine)	Meat, offal, fish, vegetables, bananas, wholegrain cereals.	Important for amino acid metabolism. Needed for the production of red blood cells and to maintain a healthy nervous system, teeth and gums.	Folic acid treatment can cause metabolic disorders.
VITAMIN B12 (Cyanocobalamin)	Liver, meat, fish, eggs, cheese. Good sources for strict vegetarians are yeast, eg Marmite, and green foods – algae such as chlorella and spirulina.	Essential for the production of red blood cells and for a healthy nervous system.	Severe deficiency can cause pernicious anaemia.
FOLIC ACID	Onion, green leafy vegetables, wheatgerm, fortified bread, nuts, eggs, pulses.	Works with vitamin B12 in the formation of red blood cells. Also important for a healthy nervous system and making genetic material such as RNA and DNA, needed for healthy babies.	Deficiency causes anaemia, particularly during pregnancy.

Water-soluble vitamins (continued)

Vitamin	Where is it found?	What does it do?	Deficiency diseases and medical uses
BIOTIN	Offal, yeast extract, milk, cheese, yoghurt, egg yolk, wheatgerm, brown rice, cauliflower and mushrooms	Not strictly a vitamin but a water-soluble co-enzyme, it works with the vitamin B complex. Important for the release of energy from food, also helps maintain healthy skin and hair.	Deficiency is rare, but can cause some skin disorders and fatigue
PANTOTHENIC ACID	Liver, eggs, wholegrain cereals, brown rice, yeast	Important for the release of energy from food. Essential for the brain, the immune system, and for healthy skin.	Deficiency is very rare, but may occur in alcoholics.
VITAMIN C (Ascorbic acid)	Citrus fruit (oranges and lemons), blackcurrants, strawberries, cabbage, broccoli, potatoes and peas	Important for healthy skin, gums, blood vessels. Also helps the absorption of iron from food.	Severe deficiency causes scurvy.



Minerals and Trace Elements

MINERAL	Where is it found?	What does it do?	Deficiency diseases and medical uses
CALCIUM	Milk, cheese, yoghurt, tinned sardines, green leafy vegetables.	Essential for strong healthy bones and teeth.	Insufficient calcium may cause rickets in children, osteomalacia ('bone softening') in adults, and osteoporosis (brittle bones) especially in older women.
MAGNESIUM	Nuts, brown rice, wholemeal bread and pasta, dried fruit, green leafy vegetables.	Important for the release of energy from food. Essential for healthy bones and teeth. Also vital for our nerves and muscles.	A lack may result in anxiety, irritability and 'restless leg syndrome'. Magnesium may be helpful in women suffering from pre-menstrual cramps or sugar cravings. Deficiency may also arise with prolonged treatment with diuretics.
TRACE ELEMENT	Where is it found?	What does it do?	Deficiency diseases and medical uses
IRON	Offal, red meat, eggs, wholemeal bread, fortified breakfast cereals, dried apricots, spinach, broccoli, tinned sardines.	Essential for making red blood cells.	Deficiency leads to iron-deficiency anaemia.
ZINC	Sardines (especially sardines), meat, liver, eggs, cheese.	Essential for growth and development, a healthy immune system, and for the functioning of many enzymes in our body.	Deficiency may cause frequent and/or severe infections, some skin conditions, delayed wound healing and growth problems.
SELENIUM	Offal, fish, shellfish, wholemeal bread, wholegrain	Important for maintaining a healthy liver. Also vital as an antioxidant.	Deficiency may occur in alcoholics. Selenium may also have a role in preventing cancer and heart disease.

OTHER MINERALS

Include potassium, phosphorus and sodium.

OTHER TRACE ELEMENTS

Include copper, manganese, molybdenum, chromium and iodine.

Daily requirements

In the past the amounts of vitamins, minerals and trace elements we need each day has been expressed as the Recommended Dietary Allowance (RDA).

However, what the RDA ignored is that we are all different and have individual requirements for these micronutrients.

So, new sets of reference values have been set which try to take account of the variety of need for example during pregnancy or illness. These are called Dietary Reference Values (DRVs). Some values are included below.

UK Dietary Reference Values (DRVs) – per day

VITAMIN A 2000-2300iu (600-700mcg retinol equivalent)

THIAMIN (B1) 0.8-1mg

RIBOFLAVIN (B2) 1.1-1.2mg

NICOTINAMIDE (B3) 6.6mg

PYRIDOXINE (B6) 1.2-1.4mg

CYANOCOBALAMIN (B12) 1.5mcg

VITAMIN C 40mg

VITAMIN D 0 (provided adequate sunlight)

VITAMIN E 3-4mg*

VITAMIN K 1mcg/kg/day*

BIOTIN 10-200mcg*

CALCIUM 700mg

CHROMIUM 25mcg*

COPPER 1.2mg

FOLIC ACID 200mcg

IODINE 140mcg

IRON 8.7-14.8mg

MAGNESIUM 270-300mg

MANGANESE 1.4mg*

MOLYBDENUM 50-400mcg*

PANTOTHENIC ACID 3-7mg*

PHOSPHORUS 550mg

POTASSIUM 3500mg

SELENIUM 60-75mcg

ZINC 7-9.5mg

* UK Safe Intake

What happens if I do not have enough vitamins and minerals?

We need vitamins and minerals to prevent and correct vitamin and mineral deficiency diseases and to give us optimum health.

The anti-oxidant story

It has long been known that vitamins and minerals, naturally found in our food, are essential for healthy tissues, such as skin, bones, nerves and blood vessels, and for the release of energy from food. Insufficient of these micronutrients leads to vitamin and mineral deficiency diseases such as scurvy and rickets.

Recent research has shown that some vitamins and minerals have a protective effect on our health. The ones we know most about are vitamins C and E, beta-carotene (converted by the body into vitamin A), and the minerals selenium and zinc.

These micronutrients are known as antioxidants and

they protect our bodies against the damaging effects of free radicals.

What are free radicals?

Our bodies need oxygen to convert food into energy. This process is called oxidation and is similar to what happens when butter goes rancid or iron rusts. It results in the formation of by-products called free radicals that are unstable and reactive molecules.



Free radicals are also produced as a result of stress, exposure to too much UV from the sun, and environmental pollutants such as cigarette smoke and car exhaust fumes. Free radicals destroy the body's cells because they each carry only a single electron (an atomic particle that has a negative charge). Nature prefers electrons to be paired, and so each free radical 'steals' an electron from one of the millions of molecules that make up each of our body's cells. The molecule 'steals' an electron from its neighbouring molecule, and so a chain reaction starts. The cell wall is

damaged and the cell's contents spill out rather similar to what happens to an egg when its shell is broken.

Damaged cells result in injury to body tissue. This may take the form of heart disease, certain cancers (especially stomach, colon, breast, lungs), arthritis, cataracts and Parkinson's disease. Free radicals are also thought to be a major factor in ageing and the formation of skin wrinkles.

Not all free radicals are harmful. We need some for our immune system to fight infection and also for some enzymes in the body. Trouble arises when there are too many free radicals.

How much anti-oxidant vitamins and minerals do we need to protect against free radicals?

If we are to protect ourselves against free radicals we need, each day, 100-150mg of vitamin C, 50-80mg of vitamin E, 10-15mg of

beta-carotene (vitamin A) and 50-250mcg of selenium. Other important antioxidants include copper, zinc and manganese.

Do we need vitamin and mineral supplements?

Many surveys over the past 20-30 years have shown that most of us do not get all we need from our food. For example US Department of Agriculture surveys in the USA estimated the vitamin and mineral status of over 12,000 people. The results showed that malnutrition was not limited to poor people but extended throughout the population.

There is no doubt that a healthy balanced diet is best. But how many people have a well balanced diet?

One analysis showed that a diet consisting only of recommended servings from the basic four food groups would supply only one tenth to one half of the RDA for vitamin E, one half of the RDA for vitamin B6 and folic acid, and inadequate amounts of thiamin, nicotinamide, vitamin B12, iron and zinc.

A 1982 survey sponsored by the US government revealed that none of the 20,000 people studied ate 100 per cent of the RDA for all major micronutrients.

In 1982 the National Cancer Institute issued guidelines to eat at least 5 servings of fruit and vegetables each day. Yet in 1990 less than 1 in 11 Americans ate this amount.

The amount of micronutrients present in foods are not always as much as expected. Losses may occur because of climate, soil depletion and the way food is harvested. Also important is how the food is shipped, stored, processed and cooked. A 1987 laboratory analysis of supermarket foods showed that the vitamin C content of oranges varied from



Supplements are supplements, not substitutes

Remember that nutritional supplements are to be taken as well as, not instead of, a good diet. Healthy eating goals should include:

- ♥ More fruit and vegetables – aim to eat at least 5 portions/day (not counting potatoes)
- ♥ More complex carbohydrates – more wholegrain, wholewheat pasta and brown rice
- ♥ Less fat – choose leaner cuts of meat and trim off visible fat
- ♥ More low-fat foods eg skimmed or semi-skimmed milk and low fat yoghurt

- ♥ 2 portions of oily fish each week in place of some meat dishes
- ♥ Less sugar (including refined sugars added to processed foods)
- ♥ Less salt – in cooking and at table and watch out for salty snacks
- ♥ Avoid excess alcohol
- ♥ Good fluid intake

Also, a healthy diet should be part of a healthy lifestyle which includes:

- ♥ exercise
- ♥ fresh air
- ♥ sleep
- ♥ avoiding tobacco
- ♥ avoiding too much sun
- ♥ avoiding too much stress

116mg each to a mere trace. The vitamin A content of each carrot analysed varied from 70 to 1,850mcg. Vitamin E in one ounce of wheatgerm varied from 3.2mg to 21mg, but if the wheatgerm was rancid there was virtually no vitamin E present.

Recently, 43 menus, designed to meet the 1990 Dietary Guidelines for Americans, and meet or exceed the highest level for adults in the 1989 US Recommended Dietary Allowances (RDAs), were analysed for 18 micronutrients. Only 11 per cent of the menus met the RDA for zinc. Half of the menus did not meet the RDA for vitamin B6, and one third did not meet the RDA for iron. This indicates that most of us

may have difficulty choosing a diet that meets current dietary guidelines.

A 1990 UK survey revealed that many British adults consume much less than recommended levels of vitamins C and E and beta-carotene (vitamin A).

Results of some antioxidant studies

In 6,000 middle-aged men the risk of angina was three times higher in men with low levels of vitamins C, E and beta-carotene (vitamin A). Another study showed that the risk of coronary heart disease was reduced by up to 50 per cent in 87,000 female nurses, 15 and 25 per

cent in 40,000 male doctors taking vitamin E supplements for two years or more.

Recent research at Cambridge University has also shown the benefits of vitamin E supplements. In a study involving 2,000 patients with coronary heart disease it was found that high doses of vitamin E reduced by half the risk of a heart attack.

In 11,000 Californians with high intakes of vitamin C the risk of heart disease was reduced by 40 per cent in men and 25 per cent in women.

In 13,000 elderly people with high intakes of beta-carotene (vitamin A) there was a reduced incidence of cancers of the mouth, throat, larynx, oesophagus, stomach, colon and bladder.

Can vitamin and mineral supplements be harmful?

Studies show that vitamins are 1,000 times safer than drugs. In a recent five-year period no fatalities due to taking vitamin and mineral supplements were reported to the American Poison Control Centres. In the same period drugs of all kinds caused at least 1,200 accidental deaths.

The water-soluble vitamins are rapidly excreted by the body so it is virtually impossible to have harmful levels.

The fat-soluble vitamins A, D, E and K are also perfectly safe so long as the daily doses recommended on the packs or labels are not exceeded.

The maximum recommended daily amounts of vitamin A are 9mg (20,000iu) for men and 7.5mg

(25,000iu) for women. Pregnant women should not take vitamin A supplements (apart from beta-carotene supplements which are safe in pregnancy), unless prescribed, because of possible birth defects. Toxic levels are quite a lot higher at 15mg (or 50,000iu) a day, which can result in liver damage, birth defects, hair loss, double vision, headaches or vomiting.

For example, liver is accepted as a food with high vitamin A levels and a 100gm helping provides 22.7mg.

The maximum recommended daily amounts of vitamin D are 10mcg (400iu) for adults. The toxic level at 50mcg (2,000iu) a day can result in kidney damage. But such toxic levels are virtually impossible to achieve.

Special needs

Some people need extra amounts of vitamins, minerals and trace elements. These include:

- People with conditions in which there is poor absorption of vitamins and minerals, for example people with Crohn's disease, ulcerative colitis, fistulae, short bowel syndrome and those taking certain medicines.
- People with diseases which require an increased intake of nutrients, for example cancer and AIDS.
- People convalescing from illness, for example following chemotherapy or radiotherapy.
- People with special or restricted diets, for example diets for kidney disease where several food groups are restricted.
- People with food intolerance, for example those with phenylketonuria and galactosaemia.
- Athletes (especially those doing endurance sports).
- Slimmers on very low calorie liquid diets, usually under specialist supervision (most vitamins and minerals).
- Smokers (who need more vitamins C, A, E, folic acid, selenium, zinc).
- Drinkers (vitamins C, B group, selenium, magnesium).
- Town and city dwellers where there is industrial pollution (beta-carotene (vitamin A), vitamins C, E, folic acid, selenium, zinc, iron, copper, manganese).
- People on short term prescription drugs (many nutrients) and long term drugs (B vitamins).
- Pregnant women (folic acid).
- Women on the Pill (vitamins C, B2, B6, folic acid, zinc, magnesium).
- Vegetarians (vitamin B12, iron, vitamin C).
- Children, especially if they are at all 'faddy' about their diet, may need extra thiamin (vitamin B1), vitamin D (especially in winter when there is less sunlight), calcium and zinc.
- Elderly people and others with a poor appetite.
- People with long-term medical conditions like arthritis or diabetes.
- Seriously or terminally ill people.

Some other nutritional supplements

Fish oils

These are rich in essential fatty acids called Omega-3 that protect the heart, blood vessels, brain and nervous system. Eskimos, who eat a diet high in fish oils but low in fresh fruit and vegetables, suffer from very low rates of heart disease.

Evening primrose oil

This contains gamma linolenic acid, needed to produce prostaglandins – complex chemicals necessary for hundreds of bodily functions. Supplements are used to help maintain healthy skin and to relieve premenstrual symptoms such as breast pain.