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## Vitamin B

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## Summary

- The B-group vitamins are a collection of eight water-soluble vitamins essential for various metabolic processes.
- Most of these vitamins can't be stored by the body and have to be consumed regularly in the diet.
- Extended cooking, food processing and alcohol can destroy or reduce the availability of many of these vitamins.
- It is important not to self-diagnose a vitamin deficiency, because some vitamins can be toxic if taken incorrectly. See your doctor or dietitian for advice.

Vitamins naturally occur in food and are needed in very small amounts for various bodily functions such as energy production and making red blood cells. There are 13 vitamins that our body needs, eight of which make up the B-group (or B-complex) vitamins.

The B-group vitamins do not provide the body with fuel for energy, even though supplement advertisements often claim they do. It is true though that without B-group vitamins the body lacks energy. The body uses energy-yielding nutrients such as carbohydrates, fat and protein for fuel. The B-group vitamins help the body to use that fuel. Other B-group vitamins play necessary roles such as helping cells to multiply by making new DNA.

## Vitamin B in food

Even though the B-group vitamins are found in many foods, they are water soluble and delicate. They are easily destroyed, particularly by alcohol and cooking. Food processing can also reduce the amount of B-group vitamins in foods, making white flours, breads and rice less nutritious than their wholegrain counterparts.

The body has a limited capacity to store most of the B-group vitamins (except B12 and folate, which are stored in the liver). A person who has a poor diet for a few months may end up with B-group vitamins deficiency. For this reason, it is important that adequate amounts of these vitamins be eaten regularly as part of a well-balanced, nutritious diet.

## Vitamin B supplements

Taking B-group vitamin supplements can sometimes mask deficiencies of other vitamins. It is also important not to self-diagnose a vitamin deficiency because some vitamins can be toxic if taken incorrectly. See your doctor or dietitian for advice.

## Types of vitamin B

There are eight types of vitamin B:

- thiamin (B1)
- riboflavin
- niacin
- pantothenic acid
- biotin
- vitamin B6 (pyridoxine)
- folate (called folic acid when included in supplements)
- vitamin B12 (cyanocobalamin).

### Thiamin (B1)

Thiamin is also known as vitamin B1 and helps to convert glucose into energy and has a role in nerve function.

More information about thiamin includes:

- Good sources of thiamin – include wholemeal cereal grains, seeds (especially sesame seeds), legumes, wheatgerm, nuts, yeast and pork. In Australia, it is mandatory that white and wholemeal flour used for bread is fortified with thiamin.
- Thiamin deficiency – is generally found in countries where the dietary staple is white rice. Deficiencies in the Western world are generally caused by excessive alcohol intake and/or a very poor diet. Symptoms include confusion, irritability, poor arm or leg (or both) coordination, lethargy, fatigue and muscle weakness.
- 'Wet' and 'dry' beriberi – this is caused by thiamin deficiency and affects the cardiovascular, muscular, gastrointestinal and nervous systems. As well as the above symptoms, a person with 'dry' beriberi suffers from a damaged nervous system due to the thiamin deficiency and may have nerve degeneration, nervous tingling throughout the body, poor arm and leg coordination, and deep pain in the calf muscles. Symptoms of 'wet' beriberi relate to the cardiovascular system and include an enlarged heart, heart failure and severe oedema (swelling).
- Wernicke-Korsakoff syndrome (also called 'wet brain') – this is a thiamin-deficiency disease linked to alcohol excess and a thiamin-deficient diet. Alcohol reduces thiamin absorption in the gut and increases its excretion from the kidneys. Symptoms of the disease include involuntary movement of the eyeball, paralysis of the eye muscle, staggering and mental confusion.

## **Riboflavin (B2)**

Riboflavin is primarily involved in energy production and helps vision and skin health.

More information about riboflavin includes:

- Good sources of riboflavin – include milk, yoghurt, cottage cheese, wholegrain breads and cereals, egg white, leafy green vegetables, meat, yeast, liver and kidney.
- Riboflavin deficiency (ariboflavinosis) – is rare and is usually seen along with other B-group vitamin deficiencies. People at risk include those who consume excessive amounts of alcohol and those who do not consume milk or milk products. Symptoms include an inflamed tongue (painful, smooth, purple-red tongue), cracks and redness in the tongue and corners of the mouth, anxiety, inflamed eyelids and sensitivity to light, hair loss, reddening of the cornea and skin rash.

## **Niacin (B3)**

Niacin is essential for the body to convert carbohydrates, fat and alcohol into energy. It helps maintain skin health and supports the nervous and digestive systems. Unlike other B-group vitamins, niacin is very heat stable and little is lost in cooking.

More information about niacin includes:

- Good sources of niacin – include meats, fish, poultry, milk, eggs, wholegrain breads and cereals, nuts, mushrooms and all protein-containing foods.
- Excessive intake – large doses of niacin produce a drug-like effect on the nervous system and on blood fats. While favourable changes in blood fats are seen, side effects include flushing, itching, nausea and potential liver damage.
- Niacin deficiency (pellagra) – people who drink excessive amounts of alcohol or live on a diet almost exclusively based on corn are at risk of pellagra. Other causes are associated with digestive problems where the body does not absorb niacin efficiently. The main symptoms of pellagra are commonly referred to as the three Ds – dementia, diarrhoea and dermatitis. Other symptoms include an inflamed and swollen tongue, irritability, loss of appetite, mental confusion, weakness and dizziness. This disease can lead to death if not treated.

## **Pantothenic acid (B5)**

Pantothenic acid is needed to metabolise carbohydrates, proteins, fats and alcohol as well as produce red blood cells and steroid hormones.

Good sources of pantothenic acid are widespread and found in a range of foods, but some good sources include liver, meats, milk, kidneys, eggs, yeast, peanuts and legumes.

Pantothenic acid deficiency is extremely rare. Symptoms include loss of appetite, fatigue and insomnia, constipation, vomiting and intestinal distress.

## **Vitamin B6 (pyridoxine)**

Pyridoxine is needed for protein and carbohydrate metabolism, the formation of red blood cells and certain brain chemicals. It influences brain processes and development, immune function and steroid hormone activity.

Some facts about vitamin B6 include:

- Good sources of pyridoxine – include cereal grains and legumes, green and leafy vegetables, fish and shellfish, meat and poultry, nuts, liver and fruit.
- Excessive intake of pyridoxine – mostly due to supplementation, can lead to harmful levels in the body that can damage nerves. Symptoms include walking difficulties and numbness in the hands and feet. Large doses of B6 taken over a long period can lead to irreversible nerve damage.
- Premenstrual syndrome (PMS) and carpal tunnel syndrome – there is some evidence that vitamin B6 may be useful in the treatment of carpal tunnel syndrome and PMS. Seek advice from a doctor before using large doses of this supplement (above 100 mg per day) because of the danger of overdose and nerve damage.
- Pyridoxine deficiency – people who drink excessive alcohol, women (especially those on the contraceptive pill), the elderly and people with thyroid disease are at particular risk of deficiency. Symptoms include insomnia, depression, anaemia, smooth tongue and cracked corners of the mouth, irritability, muscle twitching, convulsions, confusion and dermatitis.

## **Biotin (B7)**

Biotin (B7) is needed for energy metabolism, fat synthesis, amino acid metabolism and glycogen synthesis. High biotin intake can contribute to raised blood cholesterol levels.

Good sources of biotin include cauliflower, egg yolks, peanuts, liver, chicken, yeast and mushrooms.

Biotin deficiency is very rare because biotin is widely distributed in foods and is only required in small amounts. Over-consumption of raw egg whites over periods of several months by bodybuilders, for example, can induce deficiency because a protein in the egg white inhibits biotin absorption. Symptoms include pale or grey skin, cracked sore tongue, depression, hallucinations, abnormal heart actions, loss of appetite, nausea, dry skin and scaly dermatitis, hair loss, muscle pain, and weakness and fatigue.

## **Folic acid (folate or B9)**

Folate is needed to form red blood cells, which carry oxygen around the body. It helps the development of the foetal nervous system, as well as DNA synthesis and cell growth. Women of child-bearing age need a diet rich in folate.

If planning a pregnancy, you should consider taking supplements or eating fortified foods (vitamins added to processed food). This is important to reduce risks such as spina bifida in the baby. Folic acid is the synthetic form of folate and is used extensively in dietary supplements and food fortification.

Some facts about folate include:

- Good sources of folate – these include green leafy vegetables, legumes, seeds, liver, poultry, eggs, cereals and citrus fruits. From September 2009, all flour used in bread making (except for flour to be used in breads listed as 'organic') has been fortified with folic acid.
- Excessive intake – folate is generally considered non-toxic, although excessive intakes above 1,000 mg per day over a period of time can lead to malaise, irritability and intestinal dysfunction. The main risk with excessive folate intake is that it can mask a vitamin B12 deficiency, so it is best to consume these two vitamins within the recommended amounts.
- Folate deficiency – the symptoms include weight loss, tiredness, fatigue and weakness, folate-deficiency anaemia (megaloblastic anaemia) and (during pregnancy) an increased risk of a neural tube defects such as spina bifida for the baby.

### Vitamin B12 (cyanocobalamin)

Vitamin B12 helps to produce and maintain the myelin surrounding nerve cells, mental ability, red blood cell formation and the breaking down of some fatty acids and amino acids to produce energy. Vitamin B12 has a close relationship with folate, as both depend on the other to work properly.

Good sources of B12 include liver, meat, milk, cheese and eggs, almost anything of animal origin.

Vitamin B12 deficiency is most commonly found in the elderly, vegans (vitamin B12 is only found in foods from animal sources) and breastfed babies of vegan mothers. Symptoms include tiredness and fatigue, lack of appetite, weight loss, heart palpitations, shortness of breath, vision loss, smooth tongue and mental problems, such as depression and memory loss.

### Where to get help

- Your doctor
- Dietitians Association of Australia Tel. 1800 812 942

### Things to remember

- The B-group vitamins are a collection of eight water-soluble vitamins essential for various metabolic processes.
- Most of these vitamins can't be stored by the body and have to be consumed regularly in the diet.
- Extended cooking, food processing and alcohol can destroy or reduce the availability of many of these vitamins.
- It is important not to self-diagnose a vitamin deficiency, because some vitamins can be toxic if taken incorrectly. See your doctor or dietitian for advice.

#### References

- Nutrient Reference Values (NRVs) for Australia and New Zealand (including recommended dietary intakes), Australian National Health and Medical Research Council. [More information here.](#)
- Australian dietary guidelines, 2013, National Health and Medical Research Council, Australian Government. [More information here.](#)
- Vitamin B, Netfit Your Definitive Guide to Health and Fitness, UK. [More information here.](#)
- Water soluble vitamins, Women's and Children's Health Network, Child and Youth Health, Government of South Australia, Adelaide & Parenting SA. [More information here.](#)

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- [Child and Youth Health SA - B group vitamins.](#)
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