

FAQ

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Vitamin B12 - ensure an adequate intake, particularly if following a plant-based diet

People who follow a vegan diet must ensure they have an adequate intake of vitamin B12, as this vitamin occurs in significant amounts in foods of animal origin. This means that vegans should ensure their vitamin B12 intake through vitamin B12-containing food supplements - and have this checked regularly by a doctor. The German Federal Institute for Risk Assessment (BfR) recommends that food supplements for adolescents aged 15 and over and adults should contain no more than 25 micrograms (µg) of vitamin B12 per daily dose. In Germany, the healthy population generally has an adequate supply of this vitamin. Vitamin B12 is involved in various metabolic processes in the body, such as blood formation, cell division and the regeneration of nerve cells.

What is vitamin B12?

Vitamin B12 is the collective name for a group of chemically similar substances that have the same effect in the body. They are also known as cobalamins. Their common structural feature is a so-called corrin ring system, at the centre of which sits a cobalt ion.

Significant amounts of vitamin B12 only occur in foods of animal origin. The vitamin is involved in various metabolic processes, such as the breakdown of certain fatty acids and amino acids as well as the synthesis of nucleic acids and proteins. It also supports the formation of red blood cells, cell division and the regeneration of nerve cells.

What is vitamin B12 needed for in the body?

In human metabolism, vitamin B12 acts as a so-called coenzyme for two enzymes (5-deoxyadenosylcobalamin and methylcobalamin). Coenzymes are substances that are necessary for the action of certain enzymes. Enzymes, in turn, accelerate biochemical metabolic reactions.

In the form of the coenzyme 5-deoxyadenosylcobalamin, for example, vitamin B12 supports the breakdown of odd-chain fatty acids and certain amino acids. This metabolic pathway is particularly important in the central nervous system. If the coenzyme is lacking, an

intermediate product of amino acid breakdown (methylmalonic acid) accumulates in the blood. This can lead to impairments of signal transmission in the nervous system - associated with the occurrence of neurological disorders.

As coenzyme methylcobalamin, vitamin B12 supports the conversion (remethylation) of the amino acid homocysteine to methionine. An important prerequisite for this is that, - In addition to vitamin B12, - sufficient amounts of vitamin B6 and folate/folic acid are present in the organism. The amino acid methionine, in turn, is an important substrate for the biosynthesis of various neurotransmitters (adrenaline, acetylcholine).

In the event of a vitamin B12 deficiency, the concentration of homocysteine in the blood rises. Elevated homocysteine levels lead to damage to the inner wall of blood vessels and therefore increase the risk of blood clots forming and associated complications.

Furthermore, a deficiency in vitamin B12 or the coenzyme methylcobalamin also disrupts the formation of nucleic acids, which store an organism's genetic information. When cells with high division rates – such as in the bone marrow, where blood is formed – are affected, this results in the clinical picture of anaemia.

Which foods are naturally good sources of vitamin B12?

A few microorganisms (e.g. bacteria) can produce vitamin B12 themselves; humans are unable to do so and must therefore take up the vitamin from their diet. The occurrence of vitamin B12 in the digestive tract (rumen or large intestine) of animals is due to the fact that the bacteria there synthesise it. It therefore occurs in significant amounts only in animal food products, especially in liver, red meat, fish, eggs and dairy produce. Bacterially fermented plant-based foods, such as sauerkraut, certain seaweed or shiitake mushrooms, may contain traces of vitamin B12; all other conventional plant-based foods contain no vitamin B12. It is therefore not possible for humans to meet their vitamin B12 requirements through plant-based foods alone. In practical terms, this means that people following a vegan diet should take vitamin B12 supplements after consulting a doctor.

Where is vitamin B12 added?

A range of foods is available that are specifically fortified with vitamin B12, such as breakfast cereals, soft drinks and various plant-based drinks like soya, oat or almond drinks.

What is the recommended daily intake of vitamin B12?

Professional bodies such as the German Nutrition Society (DGE) estimate a daily intake of 4 micrograms (µg) of vitamin B12 is sufficient to meet the daily requirement for aged 13 and over, as well as adolescents and adults. With this intake, requirements can also be met on a vegetarian or vegan diet. A slightly higher requirement is assumed for women who are pregnant or breastfeeding. The DGE specifies 4.5 and 5.5 µg/day respectively as estimated values for an adequate vitamin B12 intake during these stages of life.

An egg, containing around 1 µg of vitamin B12, provides a quarter of the DGE's estimated value, whilst a portion of mozzarella cheese provides half of that with 2 µg. A portion of

cooked beef already contains more vitamin B12 than the DGE recommends should be taken up daily for an adequate intake.

What is the status of vitamin B12 intake amongst the population in Germany?

The available data indicate that in Germany, the reference values for vitamin B12 intake are met in all age groups and, in some cases, even far exceeded. Vitamin B12 intake is therefore ensured in the healthy general population.

People who follow a vegan diet and, due to avoiding animal food products, do not take up vitamin B12 through their regular diet, are at an increased risk of inadequate vitamin B12 intake if they do not take up the vitamin through food supplements. The limited study data available to date suggest that vegans are aware of this – and act accordingly; however, further studies and targeted information on this topic are needed.

Older people and those with certain stomach or bowel conditions, such as atrophic gastritis, Crohn's disease or ulcerative colitis, are also at increased risk of vitamin B12 deficiency.

What is the level of awareness about the health risks of vitamin B12 deficiency?

If an insufficient supply of vitamin B12 results from a medical condition or dietary factors, the metabolic processes supported by the vitamin are the first to be affected. A classic deficiency affects blood formation. Anaemia is accompanied by paleness, tiredness, tingling or numbness. In addition, neurological and psychological disorders (memory problems or depressive moods) or gastrointestinal disorders (e.g. a burning sensation on the tongue, loss of appetite, constipation) may also occur.

Important to know: the occurrence of a vitamin B12 deficiency often occurs after years of insufficient intake, because the body is able to store around 2 to 5 milligrams (mg) of the vitamin and can thus maintain sufficient levels over a long period. After approximately one to four years on a vitamin B12-free diet, the vitamin B12 stores in the liver are depleted by half; it is only when these stores have fallen to a concentration of 5-10 per cent that the first clinical symptoms become apparent.

What is the level of awareness about the health risks of vitamin B12 excess?

To date, no adverse health effects have been observed, even with a high intake of vitamin B12 from normal foods. Furthermore, no adverse effects have been observed to date with an intake of 100 micrograms (µg) of B12 per day via supplements. Recent epidemiological studies suggest that long-term intake of high amounts of vitamin B12 in the form of supplements, or high plasma levels, may be associated with an increased risk of adverse health effects.

Who should take particular care to ensure an adequate intake of vitamin B12?

The risk of vitamin B12 deficiency is particularly high for vegans. However, people who follow a vegetarian diet – that is, who consume animal food products such as eggs or dairy produce, but no meat – also face an increased risk of an inadequate intake of vitamin B12

and the associated health problems in the long term. Finally, older people and those with certain stomach or bowel conditions, such as atrophic gastritis, Crohn's disease or ulcerative colitis, are also among the affected persons with vitamin B12 deficiency.

All these groups of people should pay particular attention to their vitamin B12 status, have it checked regularly and, if necessary, take a vitamin B12 supplement after consulting a doctor.

Is vitamin B12 supplementation generally recommended?

Food supplements are generally unnecessary for healthy people who follow a balanced and varied diet. In such cases, vitamin B12 supplements are also unnecessary. This is all the more true given that there is no awareness that a targeted increase in the intake of vitamins such as B12 provides any additional health benefits.

Only in certain cases does it make sense to specifically supplement the diet with individual nutrients. In the case of vitamin B12, this applies to the groups of people mentioned above, namely those who follow a vegan or vegetarian diet, older people and people with certain stomach or bowel conditions such as atrophic gastritis, Crohn's disease or ulcerative colitis.

In 2010, the European Food Safety Authority (EFSA) conducted an assessment of numerous health claims relating to food in connection with vitamin B12. It was recognised that vitamin B12 contributes to normal homocysteine metabolism and the normal functioning of the nervous system and mental health, is required for cell division and can reduce tiredness and fatigue. However, it is not necessary to take food supplements to achieve these beneficial effects; on the contrary, a balanced diet is sufficient. Furthermore, there is no evidence that the functions mentioned above can be improved in people with an adequate intake of the vitamin by taking additional vitamin B12 via food supplements.

Are there legal maximum levels for vitamin B12 in food?

Although Directive 2002/46/EC on food supplements provides for the setting of maximum levels for the addition of vitamins and minerals to food supplements, no binding maximum levels have yet been established either at national or European level. Consequently, there are no legally prescribed maximum levels for the of vitamin B12 to food supplements or to conventional foods.

Important to note: Although food supplements are available in the form of tablets, coated tablets or powders, they are not medicines, but foodstuffs intended to supplement the normal diet. As foodstuffs, they must above all be safe for health and must not cause any adverse effects. Nor must they be intended to cure or prevent diseases. Unlike medicines, which undergo an authorisation process, food supplements are subject only to a registration requirement with the Federal Office of Consumer Protection and Food Safety (BVL). Manufacturers and distributors are responsible for the safety of the products. The monitoring of food supplements available on the market and of the manufacturing facilities is the responsibility of the food control authorities of the German federal states ("Laender").

What maximum amounts does the BfR recommend for vitamin B12?

The BfR has proposed maximum amounts for the use of vitamins and minerals in food , including vitamin B12.

Accordingly, the BfR recommends that no more than 25 micrograms (µg) of vitamin B12 be added to food supplements per daily dose of the relevant product. At this amount, no health effects are expected, even when taking into account the possible repeated intake of vitamin B12-containing food supplements and the consumption of foods fortified with vitamin B12 in accordance with the BfR's recommended maximum levels. At the same time, consumers are enabled, where necessary, to obtain a significant additional intake of vitamin B12 via food supplements.

For the fortification of solid foods with vitamin B12, the BfR recommends a maximum level of 6 µg per 100 grams (g); for beverages, a maximum amount of 1.6 µg per 100 millilitres (ml).

Where can I find further information?

On the BfR website, you will find a wealth of further information on this topic, for example on vitamin B12 or on food supplements, such as here:

- Communication: Veganism: Vitamin B12 is well supplemented, but iodine is the cause for concern

<https://www.bfr.bund.de/en/press-release/veganism-vitamin-b12-is-well-supplemented-iodine-is-a-matter-of-concern/>

- The BfR recommended maximum intake for vitamin B12

<https://www.bfr.bund.de/en/release/maximum-levels-for-the-addition-of-vitamin-b12-to-foods-including-food-supplements/>

- FAQs on food supplements

<https://www.bfr.bund.de/en/service/frequently-asked-questions/topic/frequently-asked-questions-on-food-supplements/>

- mikroco-wissen.de – Interesting facts about micronutrients and more

<https://www.microco.info/>

About the BfR

The German Federal Institute for Risk Assessment (BfR) is a scientifically independent institution within the portfolio of the German Federal Ministry of Agriculture, Food and Regional Identity (BMLEH). It protects people's health preventively in the fields of public health and veterinary public health. The BfR provides advice to the Federal Government as well as the Federal States ('Laender') on questions related to food, feed, chemical and product safety. The BfR conducts its own research on topics closely related to its assessment tasks.

The internet portal www.microco.info provides information on vitamins, minerals and numerous other substances that we ingest with food or that are offered as food supplements. In addition, the individual pages contain the maximum levels of vitamins and minerals in food supplements and in fortified foods as recommended by the German Federal Institute for Risk Assessment (BfR).



This text version is a translation of the original German text which is the only legally binding version.

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