

## Introduction

A varied and well balanced vegan diet containing plenty of fresh fruits and vegetables, cereals, legumes, nuts and seeds can not only be a very healthy diet, but is more "environmentally friendly" and, of course, much kinder to animals. Such a diet can effectively meet protein, calcium, iron, zinc, and other essential nutrient requirements, while reducing intakes of saturated fats and cholesterol. There is one vitamin, however, that vegans are advised to pay particular attention to: Vitamin B12.

## What is "Vitamin B12"?

Vitamin B12 is the general term which covers a group of compounds called corrinoids. Most of the corrinoid compounds, although predominantly cyanocobalamin (the free vitamin), can be converted into the active forms, methylcobalamin and 5-deoxyadenosylcobalamin.

## How is it absorbed?

Once vitamin B12 in food enters the stomach it is freed from the food by stomach acid. Within the stomach the free vitamin then binds with R-protein (produced in the salivary glands). In the small intestine it is released from R-protein and then binds to intrinsic factor (produced in the stomach). It then travels to the last section of the small intestine (the ileum), where it is again freed and finally absorbed by cells lining the intestine. These cells transfer it to transport proteins called transcobalamins and it is transported via the blood stream to liver, bone marrow and blood cells. Once inside these cells it is finally converted to its active forms, methylcobalamin and 5-deoxyadenosylcobalamin. Unlike the other water-soluble vitamins, vitamin B12 can be stored in the body.

Approximately, 60% is stored in the liver and about 30% is stored in the muscles.

## Why do we need vitamin B12?

Vitamin B12 is involved in a variety of reactions in the body. One of the active forms, methylcobalamin, is most importantly required in the activation of folate. Folate is essential for the synthesis of DNA, cell division, and the maturation of red blood cells and other cells, and in the absence of methylcobalamin, it is trapped in its inactive form. The other active form of B12, 5-deoxyadenosylcobalamin, is required in the maintenance of the myelin sheath which insulates nerve fibres. This is crucial for a healthy nervous system.

## How much vitamin B12 do we need?

The Australian Recommended Dietary Intake of B12 is 2.0 micrograms per day (i.e. two-millionths of a gram). Although this is a minute quantity, B12 should not be underestimated as an essential nutrient, particularly for women when pregnant or breastfeeding, as an infant is reliant on its mother's B12 intake for normal development. The liver can store about 3-6 years supply of B12 so it is therefore not necessary to consume the vitamin every day, but a regular intake, at least three times a week, is highly recommended.

## Dietary Sources

All the B12 in nature is produced by microorganisms, bacteria, fungi, and algae; plants and animals cannot synthesise the vitamin. Animal foods are sources of B12 because animals ingest B12-containing microorganisms or because they are able to absorb some of the B12 produced by their intestinal bacteria. Plant foods may contain some B12 if they are contaminated with B12-containing

bacteria. In Australia and other developed countries, it is likely that most or all of this B12 is removed when the food is washed and prepared.

In humans, microorganisms in the large intestine synthesise B12, but synthesis occurs beyond the point at which the vitamin can be absorbed. In some people, B12-producing bacteria do exist in the small intestine, so the vitamin manufactured by these bacteria can (in theory at least) be absorbed. Exactly what contribution this makes to the daily B12 intake of vegans is unknown.

Edible seaweeds (e.g. nori, wakame, kombu), fermented soy foods (e.g. miso, tempeh) and spirulina, which have been promoted as good sources of B12, actually contain B12 analogues. These compounds are structurally very similar to B12 but are inactive, and they can actually impair the utilisation of active B12 by blocking its absorption.

Due to its importance in the body and the fact that active forms are not present in plant foods, it is strongly recommended that vegans either regularly consume adequate quantities of B12-fortified products (e.g. Sanitarium Marmite and some brands of soymilk) or take a supplement at least twice a week. (For a list of some supplements that are suitable for vegans, refer to the Vitamin & Mineral Supplements page on our website).

### **What happens if we don't get enough B12?**

The liver can store about 3-6 years supply of B12 so it can take years for a deficiency to develop, although this is not always the case.

Most cases of B12 deficiency occur in the general population and are due to a lack of intrinsic factor, which results in little of the vitamin being absorbed, regardless of dietary intake. A deficiency, from either inadequate intake or inadequate absorption, can eventually lead to pernicious anaemia when body stores are depleted. The key factors of pernicious anaemia are megaloblastic anaemia and neurological degeneration. Megaloblastic anaemia is the release into the circulation of immature, large, fragile, and malformed red blood cells, and is caused by B12's role in folate activation (a B12 deficiency can contribute to a secondary folate deficiency). The neurological abnormalities are due to progressive damage to the brain, cranial nerves, spinal cord and/or peripheral nerves because of an impairment in myelination. Symptoms of pernicious anaemia include weakness, red and painful tongue, mental slowness, memory loss, walking difficulties and tingling/numbness in the fingers and toes. Among vegans, neurological symptoms are more likely to occur first because vegans generally consume high levels of folate which protects them somewhat from the anaemia. If you are concerned about your B12 level a simple blood test at your local medical centre will give an indication of your current B12 status.

In conclusion, it is worth restating that regularly taking a supplement or consuming fortified foods is highly recommended for vegans, especially due to the symptoms of B12 deficiency being vague and not always detectable until permanent damage has occurred. It is far preferable to err on the safe side than wait until a problem occurs.