

# Vitamin B12 and Vegan Diets

A vegan diet is one that offers optimum health when rich in whole grains, legumes, seasonal vegetables (land & sea), fruits, nuts, essential omega oils, sunlight and some type of physical exercise with a meditative practise that collectively provide us with an abundance of vitamins and minerals to meet our bodily needs.

However, there is one vitamin from the B family, called vitamin B<sub>12</sub>, which may present a genuine nutritional issue, although one that need not be so provided there is adequate intake of B<sub>12</sub> in the diet to meet individual needs. Naturally, not all agree on how our body assimilates B<sub>12</sub>, the sources of B<sub>12</sub>, or the amount of B<sub>12</sub> we need to maintain our individual health. What is offered in here represents the most commonly held views I can find on B<sub>12</sub>. All references are noted at the end of this newsletter, with the main bulk of the information coming from the UK Vegan Society & Vegan Outreach that I have relied upon heavily and do encourage you to investigate further.

Our understanding of nutrition is never static but ever expanding, often challenging the status quo of the day. What is held to be true today may well be improved upon or shown to be flawed in some way, or even invalidated, the next. Nonetheless, until that time and with what research has shown up until now, the wisest course is to listen to the general consensus on what our needs of B<sub>12</sub> are today and to follow those recommendations.

## Vitamin B<sub>12</sub> Origins

B<sub>12</sub> is a vitamin exclusively synthesised by single celled micro-organisms; bacteria and fungi. No plant or animal can synthesise this vitamin but are the micro-organisms' hosts. These single celled microscopic organisms are a natural part of the world found in varying degrees in the soil, the air, the rain, the rivers, the lakes, the seas, in us and all our fellow creatures.

## What is B<sub>12</sub>?

B<sub>12</sub> is one of the seven complex B vitamins essential for our health. Out of the seven, it was the last vitamin to be discovered, in 1949, and the one needed by the body in the smallest known measure for any vitamin. Commonly known as 'cobalamin', named so due to the presence of the mineral cobalt found in the centre of the molecule, in commercial preparations a molecule of cyanide is attached creating 'cyanocobalamin'. These are the most commonly used terms found on fortified foods and supplements, and you can be sure they are bioavailable forms of B<sub>12</sub>.

## The Role of B<sub>12</sub>

B<sub>12</sub> is involved in several vital functions but its primary functions are for cells that reproduce rapidly such as red bloods cells, produced in our bone marrow, and the maintenance of the insulating fatty protective myelin sheaths that surrounds nerve fibres. B<sub>12</sub> also helps build genetic material (DNA) and immunity, important for fertility and during pregnancy.

## Ferments

Until the early to mid part of the last century in developed nations, B<sub>12</sub>- producing micro-organisms were much more an integral part of our daily diets, until the advent of the industrial food age. Our food system became highly sanitized (rightly so in many instances) and we more hygienic in our food preparation, i.e. washing all fresh produce, cleaning work surfaces, refrigerating, etc. Fermented products were one possible medium through which B<sub>12</sub> found its way naturally into our diets under conditions that would be considered less than sterile, even illegal by today's standards, which allowed the natural inoculation/contamination of B<sub>12</sub> to occur.

Today most manufacturers apply very stringent hygienic standards and use stainless steel vats and machinery that all help intentionally to inhibit and/or destroy the proliferation of micro-organisms. Tempeh analysed for B<sub>12</sub> levels present produced in the USA and the Netherlands showed levels that were very low or non-existent. However, Thai and Indonesian tempeh showed active levels of B<sub>12</sub>. This was attributed to less sterile environments that allowed the natural inoculation and propagation of B<sub>12</sub> to take place. Many tempeh makers in the West now self inoculate the tempeh with B<sub>12</sub> producing micro-organisms to make it the legitimate source it once used to be.

Here in Japan a small percentage of miso, shoyu and pickles are still produced by traditional methods dating back hundreds of years using wooden vats that promote bacteria proliferation that is essential to the process. These ferments have been advocated by some as sources of bioavailable B<sub>12</sub> and this may be so. However, most research has shown the levels of B<sub>12</sub> to be negligible or non-existent and therefore they should not be merited as dependable sources.

Whatever the levels are, the presence of other beneficial bacteria in these fermented products, particularly if traditionally produced, would certainly enhance the uptake of any B<sub>12</sub> present in the digestive tract. Again, they should not be relied upon as dependable sources.

For the most part nutritional studies that have looked at macrobiotic vegan diets have shown negative results, especially in children, citing physiological and neurological irregularities when supplementation of B<sub>12</sub> did not take place,

as has been documented in the Netherlands and the USA. Happily for most, any problems were corrected upon the introduction of B<sub>12</sub> supplementation.

However, there are always exceptions to the rule as one case study here in Japan in 1995 showed when 4 non-vegan children and 6 vegan children's overall health was compared. The vegan children were raised by long term vegan mothers and breastfed. The mothers supposedly took no B<sub>12</sub> to supplement their diets or that of their children. The vegan children followed a 'genmai saishoku' (Brown Rice Vegetable Diet). The diet was based on brown rice, buckwheat, azuki and kidney beans, shiitake, seasonal vegetables, seaweeds; nori, wakame, kombu, hijiki, shoyu, miso etc. and the foods were organic with many naturally high in cobalt, essential for the manufacture of B<sub>12</sub>.

None of the many measurements of the 2 groups showed any significant differences in the children, including B<sub>12</sub> and iron levels. What is most surprising is the vegan children in the study were vital, healthy 8 year olds, contrary to results taken from other studies that show that when B<sub>12</sub> supplementation is withheld neurological or physiological growth in children is retarded.

Possible sources of the vegan children's B<sub>12</sub> put forward were: 1) nori and other seaweeds; 2) small amounts of B<sub>12</sub> from plants grown on soil fertilised with animal manure; 3) from their mothers own stores whilst breastfeeding. However, the above have been shown in other studies to be inconsistent and inadequate sources.

This is pure supposition, but perhaps part of the answer to this mystifying paradox is the fact that, in addition to all the above, the vegan mothers were also using traditionally fermented products like miso, shoyu, pickles, and including natto (not mechanised mass produced store bought products). These do enhance the production and uptake of B<sub>12</sub> in the digestive tract and may well contain very small amounts of B<sub>12</sub>.

## Soil and Raw Foods

Another avenue that B<sub>12</sub> used to find its way into our diets in the past was from the unwashed or lightly washed organic vegetables or fruit with particles of soil still intact. These would be teaming with micro-organisms including small amounts of B<sub>12</sub>, especially if night soil (human manure) or animal manure had been applied. Both human and animal manure have significant levels of B<sub>12</sub>.

Today, modern intensive farming methods dependent on agrochemicals inputs are unfortunately the norm. These inputs, being acid based, have turned an ideal bacteria and fungi terrain into an uninhabitable acidified environment. B<sub>12</sub> producing organisms and other beneficial micro-organisms are unable to thrive or survive in this kind of environment. Agrochemical inputs not only have a detrimental affect on soil organisms but the low nutritional quality and vitality of the food grown under such conditions undermines our health. This is further compounded by the very high probability of pathogens i.e. E-coli, antibiotics and growth hormones being present in the manure from factory farmed animals that is applied to farmland.

Most health professionals strongly advise those following a raw food vegan diet to not solely rely upon organically grown fresh produce, as their only source of B<sub>12</sub>. Even though B<sub>12</sub> may be present, the levels are too inconsistent to be reliable and, at times, not even present.

Though its authenticity has been questioned, a case study in late the 1950's in Iran of a group of vegans who took no supplements but used night soil to fertilise their crops, found them not to be B<sub>12</sub> deficient. The use of night soil is still common practice in many developing nations - this combined with food preparation practices that naturally promote the propagation of B<sub>12</sub> in their diets. B<sub>12</sub> is typically found at high levels in tempeh and other ferments in these areas.

## Dietary Sources of B<sub>12</sub>

The most concentrated source of B<sub>12</sub> is animal products. Again, no plant or animal can produce B<sub>12</sub>. It is produced by micro-organisms present in the gut of the animal, often ingested while grazing, tearing up tufts of grass, that include roots and soil, even their own faeces, where B<sub>12</sub> organisms are often present ending up in the flesh or milk of the animal.

Naturally, animal products are unacceptable B<sub>12</sub> sources for vegans. Vegans and some vegetarians depend on supplements, fortified foods such as cereals, soya milks, and other fortified beverages as good dietary sources of B<sub>12</sub>. Nutritional yeast, *saccharomyces cerevisiae*, is a natural whole plant grown as a food crop that has been the standby source for vegans and vegetarians for decades. It is produced commercially by growing B<sub>12</sub> cultures on a molasses or sugar cane medium and then harvested using a centrifuge collection system. Not all nutritional yeasts contain B<sub>12</sub> so it is highly advisable to read the list of ingredients and/or even call the manufacturer if in doubt.

## B<sub>12</sub> in the Digestive Tract and Liver

B<sub>12</sub> is synthesised in large amounts in the colon, with lesser amounts found in the gastrointestinal tract, and the saliva. However, it seems humans, unlike many herbivorous mammals, are unable to digest enough of the B<sub>12</sub> synthesised by beneficial bacteria present in our own digestive system.

An adult can store between 2-5mg of B<sub>12</sub> in the body, with the liver accounting for 80%. Normally, B<sub>12</sub> is secreted into the small intestine (this can vary from 1 to 10mg a day) along with bile and other secretions with around 70% effectively reabsorbed. This is known as enterohepatic circulation. But this does not add to the body's B<sub>12</sub> stores. People

on diets low in B<sub>12</sub>, including vegans and some vegetarians, may be obtaining more B<sub>12</sub> from reabsorption rather than from dietary sources, and levels will decline if not supplemented by diet. Reabsorption is the reason it can take over 20 years for deficiency disease to develop in people changing to diets low or absent in B<sub>12</sub>. In comparison, if B<sub>12</sub> deficiency is due to a failure in absorption it can take only months for deficiency to occur.

## Deficiency, Malabsorption & Risks in Vegans and Vegetarians in the General Population

B<sub>12</sub> deficiency is a serious disorder, but it is never just a B<sub>12</sub> deficiency, because vitamin and mineral deficiencies never happen in isolation. 95% of B<sub>12</sub> deficiency appears not in vegan or vegetarian communities but in the general population. In actuality, B<sub>12</sub> deficiency is lower when vegans and vegetarians follow dietary recommendations for B<sub>12</sub> than for the general population.

The most common cause of vitamin B<sub>12</sub> deficiency is not one of insufficient B<sub>12</sub> in the diet but the intestines inability to absorb it. The clearest indication of a deficiency of B<sub>12</sub> is pernicious anaemia that is attributed to the stomach's gastric juices losing its' *'intrinsic factor,'* a mucoprotein enzyme that makes the uptake of B<sub>12</sub> efficient. This loss occurs as people age and the stomach lining loses its ability to synthesize the intrinsic factor. Intrinsic Factor can also be destroyed by stomach surgery, parasites and bacterial excess in the gastrointestinal tract. The over-consumption of alcohol, coffee, contraceptive pills and just a very bad diet and improper food-combining practices can also compromise intrinsic factor function.

In normal absorption, the intrinsic factor is secreted into the stomach contents where it attaches itself to the B<sub>12</sub> in the presence of calcium, carrying the B<sub>12</sub> into the lower part of the small intestinal tract, the ileum, where the B<sub>12</sub> is readily absorbed into the blood stream. B<sub>12</sub> is then carried by the TC11 (transcobalamin II) carrier protein to the cells where it is needed.

The earliest indicators of a deficiency in adults are weakness, listlessness, fatigue, depression, and indigestion. Other signs are paleness, numbness in the extremities, heart palpitations, anorexia, and shortness of breath, infertility, and mental imbalances including faltering memory, moodiness, apathy, paranoia, hallucinations, violent behaviour, personality changes and other derangements. Typical deficiency symptoms develop gradually over several months to a year before being recognized as being due to B<sub>12</sub> deficiency and they are usually reversible on administration of B<sub>12</sub>. There is however no entirely consistent and reliable set of symptoms for either non-vegans or vegans.

These conditions tend to appear in varying degrees and it is mainly the elderly who experience them and more severely. If the deficiency continues untreated and progresses to the advanced stages, the protective myelin sheaths on the nerves and brain deteriorate, resulting in diminished sense of weight and balance in the lower extremities, tingling skin and further memory degeneration, loss of sensory and mental sharpness, visual impairment and incontinence. In the final stage before death, irreversible paralysis and brain damage occur. If you feel you are exhibiting any of above symptoms you should seek professional help to diagnose whether you are in fact deficient, or suffering from an unrelated condition.

Most vegans consume enough B<sub>12</sub> to avoid clinical deficiency. However, there two subgroups of vegans who are at particular risk of B<sub>12</sub> deficiency; long-term vegans who avoid common fortified foods (such as raw food vegans or macrobiotic vegans - who may dispute this) and breastfed infants of vegan, or even vegetarian mothers whose own intake of B<sub>12</sub> is low.

Infants typically show more rapid onset of symptoms than adults. B<sub>12</sub> deficiency may lead to loss of energy and appetite and failure to thrive and if not promptly corrected this can progress to coma or death. Again, there is no entirely consistent pattern of symptoms. Infants are more vulnerable to permanent damage than adults. Some make a full recovery, but others show retarded development.

## The Homocysteine Connection

Another important role of B<sub>12</sub> is helping the body rid itself of homocysteine. This is a potentially damaging waste product of the amino acid methionine that, in excess, can damage the delicate lining of the artery walls and can lead to heart disease. Whilst most vegans B<sub>12</sub> levels are adequate and make clinical deficiency unlikely, nonetheless, they show restricted activity of B<sub>12</sub> related enzymes, which leads to elevated homocysteine levels. Strong evidence has been gathered over the past decade that even slightly elevated homocysteine levels increase risk of heart disease and stroke and pregnancy complications.

Homocysteine levels are also affected by other nutrients, most notably folate. General recommendations for increased intakes of folate are aimed at reducing levels of homocysteine and avoiding these risks. Vegan intakes of folate are generally good, particularly if plenty of green vegetables are eaten. However, repeated observations of elevated homocysteine in vegans, and to a lesser extent in other vegetarians, show conclusively that B<sub>12</sub> intake needs to be adequate as well to avoid unnecessary risk.

## Recommended Daily Allowances

National recommendations for B<sub>12</sub> intakes vary significantly worldwide from one to three micrograms (mcg, ug) daily. A microgram is one-millionth of a gram or one thirty-millionth of an ounce the smallest possible measure of a vitamin. The US recommended intake is 2.4 mcgs a day for adults; for women this rises to 2.6 mcgs while pregnant (needed for cell division that occurs during pregnancy) and rises to 2.8 mcgs for nursing mothers, being absolutely essential during this time. The German recommendation is 3 mcgs a day with the UK's being 2 mcgs a day. Recommended intakes are usually based on 50% absorption, as this is typical for small amounts from foods. To meet the US and German recommendations you need to obtain sufficient B<sub>12</sub> to absorb 1.5 mcgs per day on average.

This amount should be sufficient to avoid even the initial signs of inadequate B<sub>12</sub> intake, such as slightly elevated homocysteine and methylmalonic acid (MMA) levels, in most people. Even slightly elevated homocysteine is associated with increased risk of many health problems including heart disease in adults, preeclampsia (toxaemia) during pregnancy and neural tube defects in babies.

## Adequate Vitamin B<sub>12</sub> Intake

Achieving an adequate B<sub>12</sub> intake is easy and there are several methods to suit individual preferences. Absorption of B<sub>12</sub> varies from about 50%, if about 1 mcg or less is consumed, to about 0.5% for doses of 1000 mcgs (1mg) or above. So the less frequently you consume B<sub>12</sub> the higher the total amount needs to be to give the desired absorbed amount. For convenience, one 50 mcgs supplement can be taken once a week.

Daily use of foods fortified with B<sub>12</sub> so that about one microgram of B<sub>12</sub> is consumed three times a day with a few hours in between will provide an adequate amount. Availability of fortified foods in Japan is limited, and more likely to be imported products, such as Eden's soya milk or Red Star's B<sub>12</sub> supplement nutritional yeast. Ensuring an adequate B<sub>12</sub> supply from fortified foods requires label reading and Japanese labels are often illegible. Another concern with locally produced fortified foods and supplements is that they may contain animal by-products.

## Testing B<sub>12</sub> Status

A blood B<sub>12</sub> level measurement is a very unreliable test for vegans, particularly for vegans using any form of algae. Algae and some other plant foods contain B<sub>12</sub> analogues (false B<sub>12</sub>) that can imitate true B<sub>12</sub> in blood tests while actually interfering with B<sub>12</sub> metabolism. Blood counts are also unreliable as high folate intakes suppress the anaemia symptoms of B<sub>12</sub> deficiency that can be detected by blood counts. Blood homocysteine testing is more reliable, with levels less than 10 mmol/litre being desirable. The most specific test for B<sub>12</sub> status is methylmalonic acid (MMA) testing. If this is in the normal range in blood (>370 nmol/L) or urine (less than 4 mg /mg creatinine) then your body has enough B<sub>12</sub>. Many doctors still rely on blood B<sub>12</sub> levels and blood counts. These aren't adequate, especially in vegans.

If you are unsure of how to go about getting tested here in Japan you can go to [www.b12.com](http://www.b12.com), Norman Laboratories, who will test your B<sub>12</sub> status using the very accurate Urinary Methylmalonic Acid "UMMA" test. Upon request the lab will send you all the necessary details by post.

## Is There a Vegan Alternative to B<sub>12</sub> Fortified Foods and Supplements?

The UK Vegan Society stance on this is: If for any reason you choose not to use fortified foods or supplements you should recognise that you are carrying out a dangerous experiment - one that many have tried before with consistently low levels of success. If you are an adult who is not breast-feeding an infant, pregnant nor seeking to become pregnant, and wish to test a potential B<sub>12</sub> source that has not already been shown to be inadequate, then this can be a reasonable course of action with appropriate precautions. For your own protection, you should arrange to have your B<sub>12</sub> status checked annually. If homocysteine or MMA is even modestly elevated then you are endangering your health if you persist.

If you are breast feeding an infant, pregnant or seeking to become pregnant or are an adult contemplating carrying out such an experiment on a child, then don't take the risk. It is simply unjustifiable.

Claimed sources of B<sub>12</sub> that have been shown through direct studies of vegans to be inadequate include human gut bacteria, barley grass, spirulina, dried nori and most other seaweeds. Several studies of raw food vegans have shown that raw food offers no special protection.

Reports that B<sub>12</sub> has been measured in a food are not enough to qualify that food as a reliable B<sub>12</sub> source. It is difficult to distinguish true B<sub>12</sub> from analogues that can disrupt B<sub>12</sub> metabolism. Even if true B<sub>12</sub> is present in a food, it may be rendered ineffective if analogues are present in comparable amounts to the true B<sub>12</sub>. There is only one reliable test for a B<sub>12</sub> source - does it consistently prevent and correct deficiency? Anyone proposing a particular food as a B<sub>12</sub> source should be challenged to present such evidence.

## Is Supplementation Natural?

Very briefly, most developed nations fortify foods; breakfast cereals, breads, pre-packaged meals etc. Vitamin A & D are added to cow's milk and to grain and bean milks along with various other vitamins. Stating that the low levels of

B<sub>12</sub> in a vegan diet and the need for supplementation is proof that such a diet is not natural, is an unfounded, even a moot argument for many vegans for various reasons: (1) The majority of B<sub>12</sub> supplements are for people who are unable to assimilate B<sub>12</sub>. (2) Modern food preparation and industrial farming have reduced the availability of B<sub>12</sub> in our diets. (3) Intentionally or unintentionally, in answer to the above losses, food technologists have discovered how to grow and harvest B<sub>12</sub> in the guises of nutritional yeast and other supplements and put it back in to our diets. (4) Veganism is a natural, humane response to the barbarity of the modern food system that denigrates sentient beings to mere numbers. (5) Dietary choices are often based on environmental, moral, ethical and/or spiritual grounds. (6) By taking supplements you are taking B<sub>12</sub> from the same source all creatures on the planet derive theirs from, micro-organisms, less the pain and suffering of sentient beings.

On a final note and dread to think: what would the vegan movement do if it is proven in years to come that micro-organisms too are sentient beings? Bon appetit!

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References: [www.vegansociety.com](http://www.vegansociety.com) B12 information sheet ~/~ [www.veganhealth.org/b12](http://www.veganhealth.org/b12) ~/~ [www.vegsoc.org](http://www.vegsoc.org) B12info ~/~ [www.beyondveg.com](http://www.beyondveg.com)~/~[www.living-foods.com/articles/b12issue.html](http://www.living-foods.com/articles/b12issue.html) ~/~ [www.cc.nih.gov/ccc/supplements/vitb12.html#what](http://www.cc.nih.gov/ccc/supplements/vitb12.html#what) ~/~ [www.yourhealthbase.com/vitamin\\_B12.html](http://www.yourhealthbase.com/vitamin_B12.html)

Books: Paul Pitchford, Healing with Wholefoods ~/~ Brenda Davis & Vesanto Melina, Becoming Vegan

B12 Supplements: [www.veganstore.com](http://www.veganstore.com) ~/~ [www.solgar.com/index.html](http://www.solgar.com/index.html) ~/~ [www.freedavitamins.com](http://www.freedavitamins.com)

B12 Testing: [www.b12.com](http://www.b12.com)

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