

Methyl groups are essential for the body to function properly and must be obtained from the diet

The need for methyl groups increases under stress

Methyl groups reduce the risk of coronary artery disease, Alzheimer's, and birth defects including spina bifida

Dietary sources of methyl groups are betaine, choline, methionine, Vitamin B6 and folic acid

Betaine is the most important source and is called a 'quasi-vitamin'; or sometimes Vitamin B10.

TOP BETAINE FOODS

Sugar beet, spinach eggs, and freshwater shrimps and prawns.

Chapter 11

Betaine – a new 'B vitamin'

Methyl groups, like vitamins, are essential in our diet. Foods that contain significant levels of the methyl groups are, in descending order, sugar beet, spinach, prawns, shrimps and eggs.

To give an idea of the importance of methyl groups, the nervous system, the immune system, the heart and blood vessels, the kidneys and the liver all depend on methyl groups to function normally^(10, 25).

A diet low in methyl groups damages all the above systems. Stress becomes more destructive, toxins become more toxic, carcinogens more carcinogenic.

In fact, a lack of methyl groups in the diet is the only dietary deficiency known to be directly carcinogenic. If there are not enough methyl groups, DNA reproduction can go wrong, leading to the activation of oncogenes⁽²⁹⁾ (cancer-causing genes).

To appreciate why a deficiency of methyl groups in the diet is so dangerous, we need to understand a process called the methyl group cycle (see diagram on next page). It's also important to know that excessive levels of the amino acid homocysteine in the body are a major risk factor for heart disease and Alzheimer's (see Chapters 14, Heart disease and 17, A healthy brain).

The methyl group is a simple combination of one carbon and three hydrogen atoms. You will see from the diagram that methyl groups from the diet combine with homocysteine in the body to form methionine. Methionine is then turned into S-adenosyl methionine (SAME).

SAMe passes on the methyl groups in the body to produce many essential compounds⁽¹²⁾. These include creatine and carnitine (important in energy production), phospholipids, (essential molecules involved in cell membrane and especially nerve health), RNA and DNA, the stress hormones epinephrine and nor-epinephrine, and the neurotransmitters involved in mood (see Chapter 17, A healthy brain). Methyl groups are also essential to the basic functioning of the immune system^(1, 13, 14, 31, 34, 35).

If there are inadequate methyl groups in the diet, all these functions are impaired. But there is a further serious implication of insufficient methyl groups in the diet.

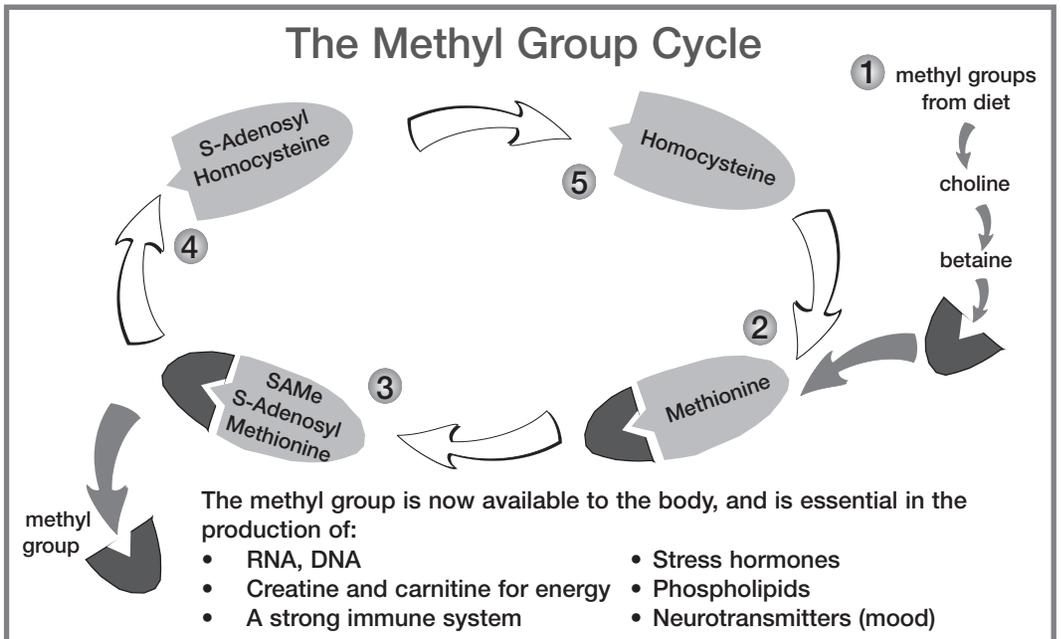
After SAMe has donated its methyl group it becomes S-adenosyl homocysteine, which breaks down into the toxic amino acid homocysteine.

If there are too few methyl groups from the diet to transform this homocysteine back again into methionine, levels of homocysteine rise and so therefore does the risk of cardiovascular disease^(24, 26, 37), Alzheimer's disease (Optima Report '97) and diabetic retinopathy⁽⁴²⁾.

How betaine reduces heart disease risk

High levels of homocysteine are predictors of heart disease and are very prevalent. This is because an estimated 90% of us have an insufficient intake of methyl groups.

Supplementation with betaine is the logical answer – and has been shown to reduce homocysteine levels (see Chapter 14, Heart disease).



THE DEFENCE BOOSTERS : **Betaine**

Methyl group depletion is very common

The Western diet typically combines an excess of protein (which contains methionine) with inadequate methyl groups.

This explains why homocysteine build-up is so prevalent – and is another reason, as well as anti-oxidant depletion, why heart disease and Alzheimer's disease are so common.

Three times better!

Each molecule of betaine donates **three** methyl groups.



LOOK FOR

...

a betaine supplement at

The body cannot synthesise methyl groups, and therefore a constant dietary intake of methyl groups is essential to maintain the cycle, in order to keep levels of SAME up and levels of homocysteine down.

The principal dietary sources of methyl groups are, in descending order, the nutrients betaine, choline and methionine; and to a lesser extent the Vitamins B6, B12 and folic acid. The vitamins are not the best donors; betaine is far more effective^{(1, 2, 7,}

^{15, 18-21, 33, 36)}.

Under conditions of stress (such as disease), the need for methyl groups increases. This is because methyl groups are needed for the formation of stress hormones, for various defence mechanisms and for the synthesis of polyamines, RNA and DNA^(34, 35), all of which are needed for tissue repair.

When stress increases the demands for methyl groups, the resulting shortfall in methyl groups inevitably leads to an increase in homocysteine – another reason why stress is bad for your health.

As an excellent methyl group donor, betaine is very effective at lowering levels of homocysteine. Most humans, however, do not consume much betaine; and in this situation, the B vitamins become the next line of defence. One recent study found that people who ate high levels of folic acid (a B vitamin) were 69% less at risk of a fatal heart attack than those whose diet contained low levels of folic acid⁽²²⁾.

Sadly, B vitamin deficiency is also all too common^(24, 26, 37) – and this explains why excessive levels of homocysteine (and therefore heart disease and Alzheimer's disease) are so common^(23, 27, 28).

A strong B complex preparation reduces levels of homocysteine^(38, 39). This is why supplements of folic acid and Vitamins B6 and B12 are increasingly being used to reduce homocysteine levels, and the risk of homocysteine-related cardiovascular and neurological diseases.

However, nearly 10% of the population cannot metabolise folic acid, and in these subjects its physiological benefits are greatly reduced⁽⁴¹⁾. Industry is now promoting the use of activated folic acid; but this is an expensive and inappropriate strategy. Betaine is the best donor of methyl groups to the cycle.

What is betaine good for?

Betaine's functions follow logically on from its role in the methyl group cycle. It reduces levels of homocysteine in the body⁽²⁴⁾, and thereby reduces risk factors for coronary artery disease and probably neonatal neural tube defects and Alzheimer's disease also.

Betaine is also essential for the process by which dietary lipids (fats) are turned into phospholipids; and so it supports liver function, as methyl group deficiency leads to fatty infiltration of the liver.

Betaine offers considerable protection against fatty degeneration of the liver, even during extreme alcohol intake^(3, 4); and this protective effect, together with betaine's other physiological role as an osmoprotectant (it protects against dehydration, and hangovers!), makes it **the** supplement for drinkers.

By feeding methyl groups into the methyl group cycle, betaine has been shown to increase resistance to various stresses, including infection⁽⁵⁾. So it has an immuno-strengthening role.

Finally, methyl groups are needed by the body to make neurotransmitters involved in controlling mood – which explains why betaine is also a useful adjunct to anti-depressant therapy – see Chapter 17, A healthy brain.

Betaine is non-toxic and, although it occurs in low levels in many species of plants and animals⁽⁶⁾, the only sources with significant levels are in plants belonging to the sugar beet (*Chenopodiaceae*) family, and freshwater invertebrates, which contain betaine at levels of up to 1.5g/kg^(16, 17). The only realistic way to get the 500mg a day that I believe to be optimal is supplementation.

Keeping a balance

A supply of methyl groups is needed to switch off genes that cause cancer. However, if taken in excess, methyl groups switch off genes that suppress cancer – unless combined with the right anti-oxidants⁽⁴³⁾. The lesson, once again, is that micro-nutrients should be taken in moderate doses, and in the right combination.

Help for heavy drinkers

A betaine supplement is especially important for the heavy drinker.

Betaine helps protect the liver from damage linked to alcohol and reduces hangovers^(3, 4, 40).

For maximum liver protection, combine with milk thistle flavonoids (see page 83).

Anti-depressant

SAME has documented anti-depressant properties; but as betaine is cheaper and a more effective methyl group donor, it is the molecule of choice in this respect – see Chapter 17, A healthy brain.

Active in the liver

Betaine is particularly active in the liver and kidney. It spares folate and choline, which may provide additional benefits⁽⁴⁵⁾.

Nutritionists – should prefer betaine to choline

Some nutritionists still recommend choline, without necessarily understanding why they are using it. But choline is not a methyl donor: it must be transformed in the mitochondria into betaine⁽²¹⁾, and it is betaine which is the ultimate provider of essential methyl groups into the methyl group cycle.

Another argument against using choline as a methyl donor is that much of it is used in the body to form acetyl choline and phosphatidyl choline, rather than

betaine^(2, 33). This is one reason why the rate of formation of betaine from choline is too slow to make enough betaine to supply the methyl group cycle^(1, 18, 20).

This is why betaine is termed a quasi-vitamin. It is the only nutrient which can supply enough methyl groups to maintain optimal methyl group levels, even under conditions of stress⁽⁹⁾.

SAME is less effective – see diagram on page 163 – and far more expensive.

SUMMARY

Betaine – ‘Vitamin B10’?

- The heart, blood vessels, kidneys, liver and immune system all depend on methyl groups to function properly.
- Under stress the need for methyl groups increases.
- A shortfall of methyl groups leads to increased levels of homocysteine, which has been linked to an increased risk of cardiovascular and neurological diseases.
- Methyl groups are essential for phospholipid synthesis in the liver. Betaine increases phospholipid synthesis. This raises HDL cholesterol (‘good cholesterol’) levels, and supports cell membranes, which helps maintain a healthy heart and brain.
- Methyl groups must be sourced from the diet.
- Betaine is the most important source of methyl groups.
- Betaine offers protection against liver damage caused by high alcohol intake.
- Betaine is non-toxic and comes from sugar beet and freshwater seafood.
- Choline and Vitamins B6 and B12 and folic acid can also contribute methyl groups, but are less effective than betaine.
- S-adenosyl methionine is expensive and not very effective.