

# Studies of TRIMETHYLGLYCINE OR BETAINE

## GENERAL DESCRIPTION

Trimethylglycine or Betaine (*Betaine is also called Betaine but we do not use this name because we can confuse it with Betaine Chloride; this is a strong acidifier that is taken only at mealtimes, and may cause gastric irritation*), extracted from sugar beets, is obtained from pure molasses, and separated by chromatography; it is a powerful methylating agent and plays a particularly important role in the process of detoxification of homocysteine (*a powerful oxidant and free radical generator*), which, as known, is one of the major cause of heart and vascular diseases.

Recent American studies have shown the value and effectiveness of T. as a dietary supplement that can give the following benefits:

- Adjuvant in cardiovascular disease
- Adjuvant in sporting competitions
- Adjuvant in liver diseases
- Adjuvant in baldness
- Adjuvant in depression
- Adjuvant in hepatitis
- Adjuvant in alcohol-induced hepatitis fatty liver
- Adjuvant in chronic general fatigue
- Increasing S-adenosyl-methionine levels
- Conflicting arteriosclerosis
- Decreasing apoplectic stroke risk
- Decreasing fat tissue amount
- Improving glucose metabolism
- Improving dry mouth
- Improving homocysteinuria which does not respond to pyridoxine improving use of oxygen
- Improving oxygen utilization
- Reducing triglycerides levels in liver
- Reducing Cholesterol
- Reducing liver lipodosis
- Useful for immune deficiency deficit (immunomodulating)
- Useful for hyperhomocysteinemia

## STRUCTURE AND PROPERTIES

From a structural standpoint, T. differs from dimethylglycine in presence of a third methyl group (CH<sub>3</sub>). T. operates very successfully in methylation or trans-methylation process, which is the process by which methyl groups (CH<sub>3</sub>) are transferred from one molecule to another; it is a biochemical process essential to life, health and regeneration of body cells. Vitamins, hormones, neurotransmitters, enzymes, nucleic acids (RNA, DNA) and antibodies largely depends on methyl groups transfer to complete their synthesis and function in humans.

There are more than 41 known transmethylations reactions in humans. For example, methyl groups convert homocysteine (toxic amino acid that can cause heart and vascular problems) into amino acid methionine, which is a beneficial amino acid, present in all kind of proteins, of which homocysteine is a normal metabolism byproduct..

Our body uses only small amounts of homocysteine but it is known that if we take some large amount, it become toxic at all.

This is not unusual for a metabolism by-product, in fact, our body has natural mechanisms of detoxification, one of this is methylation.

However, there are some genetic defects that cause a significant increase of homocysteine levels in the blood, which allowed us to discover that **homocysteine is the primary cause of heart disease. It was also shown that homocysteine also causes atherosclerosis.** The atherosclerosis begins when we have a freeze on nitric oxide production (NO) by endothelial cells. This block is commonly called *EDRF [endothelial, derived relaxing factor]*.

Nitric oxide not only relaxes arteries but also prevents the formation of plaques. High concentrations of homocysteine blocks EDRF thereby starting arteriosclerotic process. **Homocysteine irritates muscle cells of arteries as well, thus causing a proliferation of the arteriosclerotic process.**

So we can say that homocysteine is merely a marker of the efficiency of methylation. Methionine (methylation product of homocysteine) produces high concentrations of SAM (S-adenosyl-methionine), a natural antidepressant and donor of methyl groups.

The increase of SAM is positive, both in prevention and treatment of several *metabolic disorders including those caused by serious organic deficit states such as in cancer patients* and those caused by alcoholic stress.

It is one of the essential amino acids with an antioxidant activity, *it is very important for the functioning of liver because it prevents an abnormal accumulation of fat and the production of antibodies and it can be converted to cystine, in the presence of vitamin B<sub>12</sub>.*

**In combination with inositol and B vitamins helps suffering livers.** It participates in the formation of carnitine, choline, creatine, adrenaline, etc. interacting with other substances to detoxify body from harmful chemicals and **it is included in the supplements as anti-fatigue agent.**

If we just take **adequate amounts of vitamin B<sub>6</sub> a lot of homocysteine we produce would be converted into methionine, which is an important deactivator of free radicals and is an antioxidant as well.** Half of homocysteine is detoxified in this manner, the other half is detoxified through another process called transmethylation. Thus it happens that the 5-methyltetrahydrofolate, which we produce from acid folic, gives its methyl group to homocysteine thus converting it into an essential amino acid: methionine.

Another way in which homocysteine is converted into methionine is by the transfer of a methyl group from T.

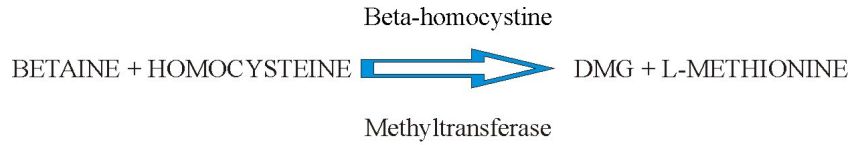
DNA of cell nucleus loses methyl groups because of the normal cellular aging. Each **molecule of T. gives three methyl groups to DNA and this helps the remethylation process, that is repairing DNA molecules. In general we can say that this program helps to repair cells to slow the aging process. T. reduces homocysteine levels in blood, a molecule that can cause arteriosclerosis, thrombosis and other damage to the body. [T. converts homocysteine to methionine and S-adenosylmethionine (SAME)].**

*Homocysteine is a sulphured amino acids, osculant of the conversion of methionine to cysteine. The conversion of homocysteine to methionine (remethylation process) or its conversion to cysteine (trans-sulphuration) represents the main metabolic pathways capable of maintaining its intracellular levels within a narrow range. Its controlled release into bloodstream, on the other hand, allows you to measure its plasma concentrations that represent an accurate index of tissue homocysteine status .*

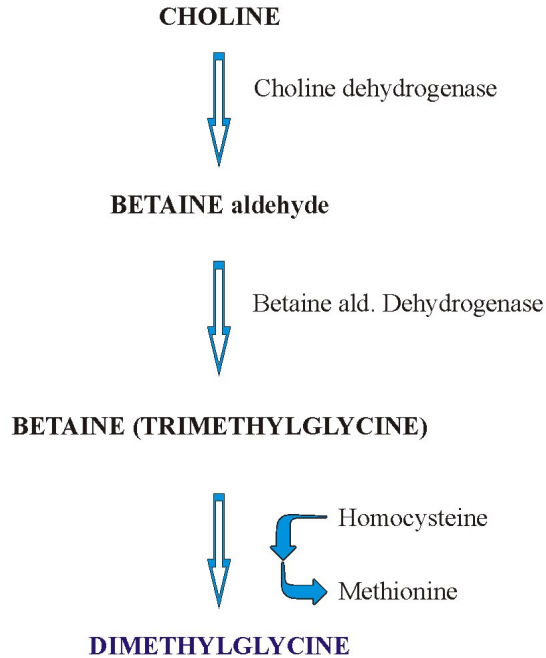
**Several epidemiological surveys have shown a correlation between clinical vascular origin incidence and homocysteine serum levels (venous thrombosis, embolic events, increased incidence of atherosclerotic diseases): in general we can say that high circulating plasma levels of homocysteine are considered a independent risk factor for vascular disease.**

**Elevated serum homocysteine levels may depend on several factors, both congenital ones (enzyme deficiencies) or acquired ones. Hyperhomocysteinemia is often correctable with appropriate treatment. By T. there is a double benefit: we donate the methyl group to produce dimethylglycine and homocysteine (Vitamin B15) (Fig. 1).**

**FIGURE 1**



**BIOCHEMICAL PATH OF TRIMETHYLGLYCINE**



To determine the ideal dosage and formulation of T. studies have been done on athletes and sedentary people and we saw that his action is so far superior to DMG (dimethylglycine), in fact, Mr. Mann, in his article appeared in the “*Journal of Megahealth Society*”, during 1984, stated that "T is a substance much far superior to the DMG and is not subject to legislative restrictions by the FDA."

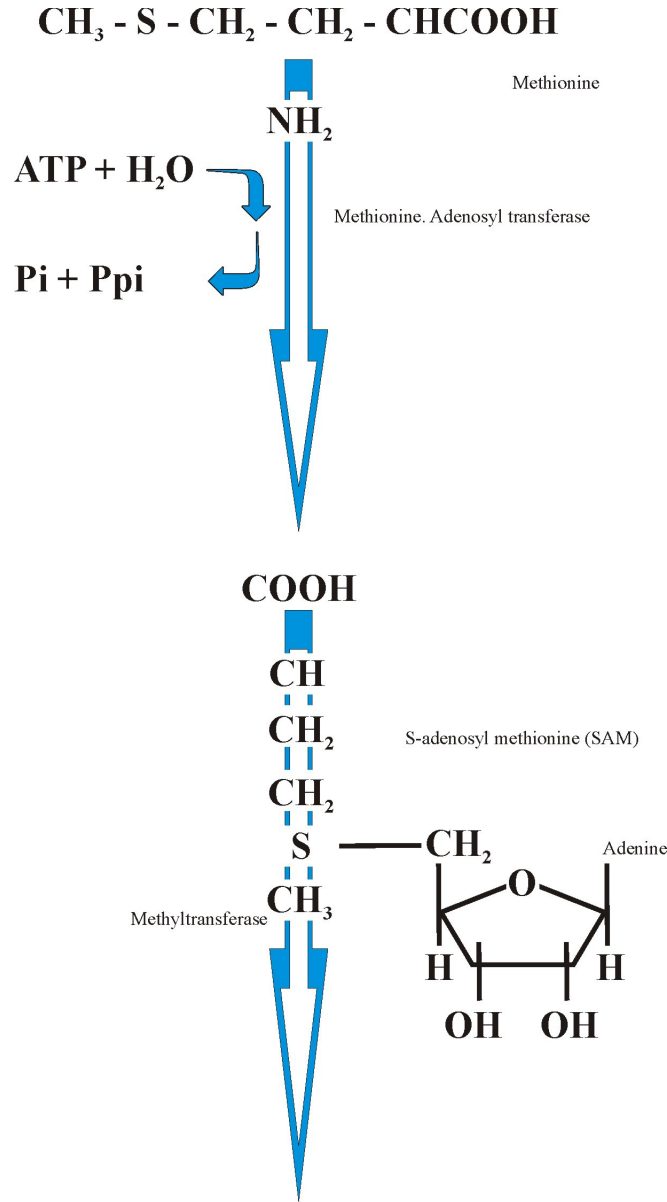
Vitamin B15 (dimethylglycine), in the past, as been used by prominent figures of the sporting world as Muhammad Ali, members of Dallas cowboys, New York Yankees for it let them use less oxygen, thus increasing energy production and stamina.

Studies in this field has shown that T. represents the ideal help for Olympic competitions, and currently they are conducting studies on athletes in competitions of thriathlon. The primary form of T. (Betaine) is anhydrous form, 99% pure, and it looks like a crystalline product with shades of light brown.

The three major compounds that have the responsibility to provide methyl groups required for different functions in the human body are Methionine, Betaine and Choline. Among these functions we recall the synthesis of proteins and the formation of membranes. Furthermore, in general, methylation plays an important role in the process of age. It may be promoted or inhibited through diet, environmental factors (smoking, alcohol, contraceptive preparations) and direct supplements, above all Folic Acid, Vitamin B12 and T..

We have already stated that methionine produces SAM (S- adenosylmetionina). Its high concentration is positive for both the prevention and treatment of a variety of liver disorders including those caused by alcohol. Homocysteine low concentrations protect DNA and produce SAM and this is the best use of methylation for Health protection (Fig. 2).

**FIGURE 2**



On October 25, 1996 Betaine anhydrous (trimethylglycine) was approved by the NDA (New Drug Application). The recommended dose is one gram per day but in Italy, the Ministry of Health has considered appropriate to assess its daily dose to 250 milligrams ; a quarter compared to the New Drug Application.

T. is not a drug. It is an amino acid being in food and is produced in the body during choline metabolism (Fig. 1). When Choline (*tetramethylcholine*) gives a methyl group, it becomes Betaine. Most of choline is converted into phosphatidylcholine and “acetylcholine”, which is the substance that transmits nerve impulses. Betaine, or Trimethylglycine, also plays a role in the manufacture of carnitine and serves to protect possible kidneys from damages. Betaine is also useful in certain rare genetic disorders involving cysteine metabolism .

*Experiments, where large amounts of lecithin and other precursors of choline that can distribute acetylcholine to brain and nervous system, were carried out on humans and animals with the following result: **increased nerve and brain functions, including increased memory, reflexes and coordination.** By using T. we can save a lot of choline reserves for the conversion to*

*acetylcholine. This may also explain the increase of muscle response in athletes after taking the T.*

T., because of its lipotropic effects, was able to induce significant improvements in several clinical trials on human beings.

*In Germany, Italy and France T. has been studied in clinical trials for the treatment of alcohol-induced liver diseases. Recent studies have suggested that T. may be the most effective way to deal with alcohol-induced fatty liver.*