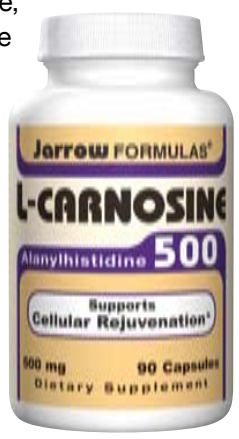
L-Carnosine: The Little Dipeptide That Could

Good things sometimes come in small packages. The amino acid derivative L-Carnosine is one of these. Chemically, it is a dipeptide (a molecule consisting of two amino acids) constructed from beta-alanine and l-histidine, hence its chemical name alanylhistidine.

L-Carnosine is found throughout the body, but it is particularly abundant in those cells which are long-lived, such as the nerve cells (neurons) and the cells of the muscles (myocytes). Similarly, L-Carnosine, as is true of the antioxidant enzyme superoxide dismutase (SOD), is one of a handful of compounds that are present in tissues at levels that correlate strongly with the maximum life spans of animal species. Research interest in L-Carnosine is focused on a number of issues arising from the ability of the compound to rejuvenate cells approaching senescence (failure due to advancing age).



Muscle levels of L-Carnosine decline approximately 63% between the ages of 10 and 70. Brain levels of L-Carnosine begin high and remain high in comparison with the levels found in most other tissues. Scientists have speculated that this may be one reason that brain functioning is stable into old age despite the brain's dependence upon glucose for energy metabolism and the unusually high ratio of fructose to glucose in the brain. L-Carnosine, however, performs more than just one role. Experiments have shown that aside from being a powerful antioxidant, it helps to prevent glycation (the damaging cross linking of sugars to proteins). It also detoxifies aldehydes and related compounds (toxins produced in the body with alcohol consumption and smoking). Furthermore, it chelates metal ions which otherwise might be free to cause damage by generating free radicals.

Protecting Against Free Radicals and More

L-Carnosine has been shown in *in vitro* (test tube) studies to significantly protect chromosomes from oxidative damage due to direct exposure to large amounts of oxygen. Tests prove that this amino acid derivative provides protection against a wide range of radicals, including the hydroxyl radical, as well as the superoxide, singlet oxygen and the peroxyl radicals. Such a breadth of protection makes L-Carnosine one of the most efficient of free radical scavengers and antioxidants available to the body.

Oxidative damage to the DNA is considered to be a prime contributor to cellular senescence. One marker for such damage is a by-product of the energy production and storage machinery of the cell known as 8-hydroxy-deoxyguanosine. When Japanese researchers studied skin cells (fibroblasts), they found that L-Carnosine significantly reduced 8-hydroxydeoxy-guanosine levels in 4-week old fibroblast cultures in comparison with the control cell lines. It has been speculated that protective effects such as these may explain how L-Carnosine improves post-surgical wound healing.

Metal ions, such as copper and zinc, are closely linked to free radical generation. Indeed, changes in the brain's copper-zinc metabolism is implicated in Alzheimer's disease and many other diseases with neurological components. For instance, copper ions interact with beta-amyloid plaques of Alzheimer's disease to generate hydrogen peroxide, which can then react with iron or copper ions to produce the even more neurotoxic hydroxyl radicals. L-Carnosine counteracts these effects not only by scavenging the radicals directly, but also by chelating excess metals and by buffering the pH (acid-base) of brain tissues.

The best measure of protection, of course, is the results of animal/human studies. When mice were fed L-Carnosine, brain levels of MDA (malondialdehyde), a highly toxic product of membrane lipid oxidation, were found to be significantly lower than in controls. Dopamine production declines greatly with aging, yet MAO-B (monoamine oxidase B) activity was 44% lower in the carnosine-treated mice, indicating maintenance of dopamine metabolism. These tests, furthermore, showed that carnosine-fed mice retained more normal behavioral reactivity and appeared to be protected from some of the damaging aspects of the excitatory neurotransmitter glutamate.

Stopping the Formation of AGEs and Brain Protein Carbonylation

The proteins which make up the tissues of the body can readily be damaged as a result of oxidation and interactions with sugars or aldehydes, such as acetaldehyde, which is produced as an aspect of the metabolism of alcohol. The major forms of undesirable protein modifications include oxidation/free radical damage, carbonylation (attachment of carbonyl groups to proteins), cross-linking, glycation and advanced glycation end product (AGE) formation. All of these changes damage a protein's ability to function normally.

Glycation refers to the oxidation of protein by glucose. In chemistry, these are sometimes called "browning" reactions, and, in fact, they are seen every time meats are "browned" by cooking. The result is a cross-linking of glucose or another sugar molecule to the protein, and action which effectively prevents the protein from acting properly.

Another and closely related type of damage to proteins is the formation of extraneous carbonyl (CO, carbon/oxygen) groups. Some authorities estimate that in older adults, one third of all proteins may become carbonylated, with a resulting decline in a variety of cellular functions. Glycation, the actions of aldehydes and peroxidation agents, etc., can all lead to protein carbonylation. L-Carnosine inhibits all of these reactions and thus effectively prevents destructive protein modifications.

The formation of AGEs is the ultimate downstream effect of glycation, one of the various forms of destructive protein modification. These AGEs bind to special receptors and this binding induces intracellular oxidative stress. The related cellular activation and generation of assorted cytokines (immune system components), growth factors and transcription factors such as nuclear factor kappa beta can have quite negative effects. L-Carnosine has been shown to "sacrifice" itself as a substitute victim to glycating agents, thus sparing the proteins and membranes which otherwise would have been the targets of glycation. Furthermore, there is evidence that L-Carnosine reacts with and removes the carbonyl groups of glycated proteins.

Promoting Cellular Rejuvenation

The ultimate test of cellular rejuvenation is the way in which an animal ages. A Russian study tested the effect of carnosine on life span and indicators of senescence in age-accelerated mice by giving half the mice carnosine in their drinking water starting at two months of age. L-Carnosine did not alter the 15 month maximum life span of this mouse strain, but the mice given carnosine were about twice as likely to reach the "ripe old age" of 12 months as were untreated mice.

L-carnosine not only extended the life span of the treated mice by 20% on average, but also the L-carnosine treated mice displayed glossier coats, fewer skin ulcers, and quite dramatically retained normal behavioral reactivity when compared with the untreated mice. Tests used to determine brain aging showed significant protection against several standard markers for decline. The mice therefore were "more resistant to the development of features in aging."

Usage

Take 1 to 3 capsules per day with juice or water on an empty stomach, or as directed by your qualified health consultant.

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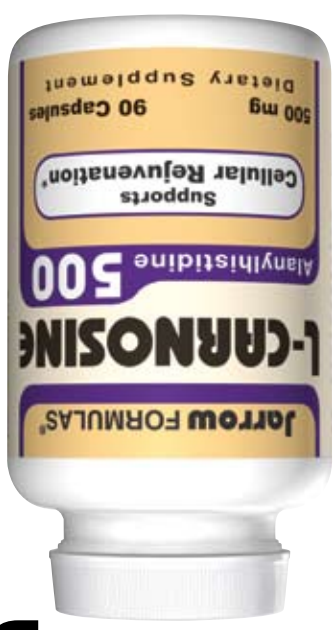

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