Amino Acids

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Proteins are comprised of amino acid chains, the basic chemical building blocks of life. Protein is needed by the body to build and repair muscles, bones, organs, glands, connective tissue, and hair. The body continually breaks down dietary protein into individual amino acids and then reassembles the amino acids into new and vital structures.

Amino acids are needed to produce protein structures for genes, enzymes, hormones, and body fluids. They also act as neurotransmitters and as precursors to neurotransmitters in the central nervous system, sending and receiving messages to the brain.

With the exception of taurine, GABA, and glycine, most amino acids are present in either the D or L form. These forms are reverse images of one another. The L form of amino acids represents the natural type found in living plants and animal tissues. The L form is used in human protein structures and is more compatible to human biochemistry than the D form. Only phenylalanine can be present in human protein structures in the D and L forms.

If the body is deficient in essential amino acids, protein synthesis is negatively affected and serious health conditions may ensue. There are many environmental sources that can contribute to a deficiency of amino acids. These include pollution, chemicals added to processed foods, hormones-drugs injected into meat products, agricultural pesticides, smoking, and consuming alcohol.

A major cause of aging is the deterioration of the energy producing components of the cell which results in reduced cellular metabolic activity, the accumulation of cellular debris, and eventual death of the cell.1-7

The amino acid L-carnitine helps to maintain cellular energy metabolism by assisting in the transport of fat through the cell membrane and into the mitochondria within the cell, where these fats are oxidized to produce the cellular energy ATP.8-12

Acetyl-L-carnitine is the acetylated ester of the amino acid L-carnitine. Acetyl-L-carnitine and L-carnitine are absorbed into the bloodstream efficiently and both are very effective at carrying fatty acids across the membrane into the cell where they are burned as energy and is utilized efficiently in the mitochondria of the cell.10-14

Caution: For some people, L-carnitine, especially acetyl-L-carnitine, may have a stimulating effect. Therefore, it may be unwise to take it in the evening.

Acetyl-L-carnitine arginate is a patent-ed form of carnitine that stimulates the growth of neurites in the brain. Studies show that acetyl-L-carnitine arginate stimulates the growth of new neurites by an astounding 19.5%, which is almost four times better than acetyl-L-carnitine.15

The acetylated form of L-carnitine (acetyl-L-carnitine) facilitates the release and synthesis of acetylcholine by donating its acetyl group to the production of acetylcholine, an important neurotransmitter.16 Acetyl-L-carnitine also enhances the release of dopamine from neurons and helps it bind to dopamine receptors.17,18 Numerous human and animal studies validate the multiple beneficial mechanisms that acetyl-L-carnitine exerts in the brain.

Acetyl-L-carnitine is more effective than L-carnitine in carrying fatty acids across the membrane into the cell where they are burned as energy. Since 1995, Life Extension members have been supplementing with acetyl-L-carnitine and deriving the many benefits this form of carnitine has shown in published scientific studies. With the discovery of acetyl-L-carnitine arginate, the benefits of acetyl-L-carnitine can now be greatly augmented.

1 capsule contains
Acetyl-L-carnitine-arginate DiHCl .................320 mg
Acetyl-L-carnitine HCl .............................300 mg
Other ingredients: gelatin, rice powder, magnesium stearate.

Dosage and use
• Take one capsule three times daily on an empty stomach or as recommended by a healthcare practitioner.
• It can be taken in divided doses before meals or all at once.

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These statements have not been evaluated by the Food and Drug Administration. This product is not intended to diagnose, treat, cure, or prevent any disease.
**Acetyl-L-Carnitine 449**
500 mg • 100 capsules

2 capsules contain
Acetyl-l-carnitine ............1000 mg
(from acetyl-l-carnitine hydrochloride)
Other ingredients: water and gelatin.

**Dosage and use**
- Take two capsules once or twice daily or as recommended by a healthcare practitioner.
- This product is best utilized when taken on an empty stomach with water or juice, in divided dosages 45 minutes before breakfast and lunch.

Retail
Price Each
one bottle
$56.00
four bottles
$46.66

Member
Price Each
one bottle
$42.00
four bottles
$35.00

**L-Carnitine Powder 051**
100 g

3/8 level teaspoon contains
L-carnitine .................1110 mg

**Dosage and use**
- Take 3/8 to 3/4 teaspoon daily or as recommended by a healthcare practitioner.
- This product is best utilized when taken on an empty stomach with water or juice.

Retail
Price Each
one bottle
$85.00
four bottles
$73.75

Member
Price Each
one bottle
$63.75
four bottles
$55.31

**L-Carnitine Capsules 156**
600 mg • 30 capsules

1 capsule contains
L-carnitine ....................600 mg
Other ingredients: silica, magnesium stearate, gelatin, water.

**Dosage and use**
- Take one capsule on an empty stomach, not exceeding four capsules daily, or as recommended by a healthcare practitioner.

Retail
Price Each
one bottle
$18.00
four bottles
$16.00

Member
Price Each
one bottle
$13.50
four bottles
$12.00

**Super Carnosine Caps 787**
500 mg • 90 capsules

Carnosine is a multifunctional dipeptide made up of a chemical combination of the amino acids beta-alanine and L-histidine. It is found both in food and in the human body. Long-lived cells such as nerve cells (neurons) and muscle cells (myocytes) contain high levels of carnosine. Muscle levels of carnosine correlate with the maximum life spans of animals.1-4

Carnosine levels decline with age. Muscle levels decline 63% from age 10 to age 70, which may account for the normal age-related decline in muscle mass and function.19

Since carnosine acts as a pH buffer, it can keep on protecting muscle cell membranes from oxidation under acidic conditions of muscular exertion. Carnosine enables the heart muscle to contract more efficiently through enhancement of calcium response in heart myocytes.20

Aging causes irreversible damage to the body’s proteins. The underlying mechanism behind this damage is glycation. A simple definition of glycation is the cross-linking of proteins and sugars to form non-functioning structures in the body. The process of glycation can be superficially seen as unsightly wrinkled skin. Glycation is also an underlying cause of age-related catastrophes including the neurologic, vascular, and eye problems. Carnosine is a unique dipeptide that interferes with the glycation process. When compared to the anti-glycating drug aminoguanidine, carnosine has been shown to inhibit glycation earlier in the process and also provides additive health benefits.

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The combination of taurine, carnosine, benfotiamine (unique synthetic variant of vitamin B1), and vitamin B1 provides a multifaceted, body-wide shield against increased aging caused by glycation.

1 capsule contains
Thiamin (vitamin B1) (as thiamine HCl) ............. 50 mg
Carnosine ........................................ 500 mg
Taurine ............................................. 200 mg
Benfotiamine ...................................... 50 mg
Luteolin (from perilla leaf extract) (Perilla frutescens) .... 4 mg
Other ingredients: gelatin and rice flour.

Dosage and use
• Take one capsule twice daily with or without food or as recommended by a healthcare practitioner.

L-Arginine/L-Ornithine

L-arginine is an essential amino acid. L-ornithine may be used as an alternative since it metabolizes to L-arginine in the body. L-arginine is required for the body to synthesize nitric oxide, which enables the arterial system to retain its youthful elasticity. Nitric oxide also helps to produce endothelial relaxation factor, which is needed by the arterial system to expand and contract with each heartbeat. Surgical or traumatic injury greatly increases the body's need for L-arginine, a key building block to repair damaged tissue and bone. Because of its role in repair of tissues, L-arginine helps to promote optimal healing of wounds. L-ornithine may also be used for this purpose.

Dosage and use
• Studies suggest that low doses of L-arginine and/or L-ornithine are unlikely to effect GH release. A minimum dose of L-arginine to promote GH release is probably eight grams. At high doses, L-ornithine can stimulate GH release. A minimum of 13 grams of L-ornithine is most likely needed to promote GH release.
• L-arginine free base powder can be mixed with water or juice; however, it is alkaline and some people find that mixing ascorbic acid with it produces a more pH neutral and palatable drink.
• Start with about 25% of your target quantity and increase it gradually over a period of a few days to minimize the occurrence of minor side effects, such as nausea.

Caution: Diabetics and borderline diabetics should use hormone releasers with care. L-arginine and L-ornithine might improve or worsen a diabetic condition.

Persons who have not completed their bone growth (children and teenagers) and pregnant or lactating women should not use GH releasers except under a physician's supervision.

L-arginine and L-ornithine sometimes reactivate latent herpes virus infections. Therefore, persons who have had ocular or brain herpes should not use them. Those with certain psychoses may experience worsened symptoms if they take L-arginine or L-ornithine supplements.

If you have high blood pressure or if you have been diagnosed with cancer, consult your healthcare practitioner before taking L-arginine products.

L-Arginine Caps 389
900 mg • 200 capsules

1 capsule contains
L-arginine HCl ................. 900 mg
Other ingredients: magnesium stearate, gelatin, water.

Dosage and use
• Take one capsule daily on an empty stomach or as recommended by a healthcare practitioner.

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L-Arginine Free Base Powder 125
300 g

1 level teaspoon contains
L-arginine ............... 3.3 g

Dosage and use
• Take one level teaspoon daily on an empty stomach, or as recommended by a healthcare practitioner.

Retail

Price Each

Member

Price Each

one bottle $39.50 $29.63
four bottles $37.50 $28.13

L-Arginine/ L-Ornithine HCL Complex 039
500 mg • 100 capsules

4 capsules contain
L-arginine ............... 1500 mg
L-ornithine HCl ............... 500 mg

Other ingredients: rice flour, magnesium stearate, gelatin, water.

Dosage and use
• Take four capsules on an empty stomach at bedtime, or as recommended by a healthcare practitioner.

Retail

Price Each

Member

Price Each

one bottle $17.00 $12.75
four bottles $13.50 $10.13
twelve bottles $11.67 $8.75

Arginine/Ornithine HCL Powder 038
150 g

1 packed level teaspoon (3g) contains
L-arginine HCl ............... 2.25 g
L-ornithine HCl ............... 750 mg

Dosage and use
• Take one packed level teaspoon daily on an empty stomach, or as recommended by a healthcare practitioner.

Retail

Price Each

Member

Price Each

one bottle $22.95 $17.21
four bottles $19.00 $14.25
twelve bottles $16.75 $10.13

L-Cysteine/N-Acetyl- Cysteine/Glutathione

L-cysteine is a conditionally essential amino acid, one of only three sulfur-containing amino acids, the others being taurine (which can be produced from L-cysteine) and L-methionine from which L-cysteine can be produced in the body by a multi-step process. Cysteine plays a role in the sulfation cycle, acting as a sulfur donor in phase II detoxification and as a methyl donor in the conversion of homocysteine to methionine. Cysteine also helps synthesize glutathione, one of the body's most important natural detoxifiers. N-acetyl-cysteine is the acetylated form of L-cysteine, which is more efficiently absorbed and used.\(^\text{54-64}\)

Glutathione (gamma-L-glutamyl-L-cysteinyl-glycine) is a peptide (short protein)-like molecule synthesized in the body from the three amino acids L-glutamic acid, L-cysteine, and glycine. Glutathione is one of the body's most important and powerful antioxidants, helping to detoxify xenobiotics. A major function of vitamin C is to keep glutathione in its reduced form so that they can continue to provide free radical quenching effects.\(^\text{65-68}\)

Even though many published studies show that garlic, selenium, alpha-lipoic acid, L-cysteine, and N-acetyl-cysteine can boost cellular glutathione levels, people with health problems may benefit from taking high doses of glutathione.\(^\text{69-73}\)

Caution: When taking L-cysteine, N-acetyl-cysteine, or glutathione, it is recommended that three times as much vitamin C should be taken at the same time to prevent these amino acids from being oxidized in the body.

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L-Cysteine Capsules 064
500 mg • 60 capsules

1 capsule contains
L-cysteine ................. 500 mg
(from L-cysteine HCl)
Other ingredients: cellulose, gelatin, purified water, magnesium stearate, MCT, silica.

Dosage and use
• One capsule daily, or as recommended by a healthcare practitioner.

Retail
Price Each
one bottle $15.95
four bottles $14.00

Member
Price Each
one bottle $11.96
four bottles $10.50

Dosage and use
• Take one capsule, one to three times daily, preferably before meals, or as recommended by a healthcare practitioner.

Retail
Price Each
one bottle $18.00
four bottles $16.00

Member
Price Each
one bottle $13.50
four bottles $12.00

N-Acetyl-Cysteine Capsules 215
600 mg • 60 capsules

1 capsule contains
N-acetyl-cysteine ............ 600 mg
Other ingredients: magnesium stearate, gelatin, water.

Dosage and use
• Take one capsule, one to three times daily, or as recommended by a healthcare practitioner.
• This product can be taken with or without food.

Retail
Price Each
one bottle $14.00
four bottles $13.50

Member
Price Each
one bottle $10.50
four bottles $10.13

Mega L-Glutathione Capsules 314
250 mg • 60 capsules

1 capsule contains
L-glutathione ............... 250 mg
Other ingredients: gelatin, cellulose, purified water, magnesium stearate, silica.

Dosage and use
• Take one capsule daily, preferably with a meal.

Retail
Price Each
one bottle $35.95
four bottles $32.36

Member
Price Each
one bottle $26.96
four bottles $24.27

L-Glutamine

Glutamine is a nonessential amino acid that is the most abundant free amino acid in human muscle and plasma. It is necessary for rapidly dividing cells, including those of the gut and immune system. It is also used as an energy source in mitochondria, and is a precursor of the brain neurotransmitter glutamate. Glutamine is also needed for optimal nucleotide biosynthesis and protein synthesis.12-17

Glutamine is a very diverse amino acid that is utilized in numerous functions that are important for daily living. People who do heavy exercising can lower their glutamine levels causing stress to their body and immune systems. For that reason supplementing with glutamine can be an important part of a serious athlete's program or someone challenged with loss of muscle, or just wanting to help maintain optimal immune function while under heavy stress.18-23

Dosage and use
• 500 mg or more may be used as needed.
• Two grams or more may be taken before exercise.
• L-glutamine is best utilized when taken on an empty stomach.

Caution: Insomnia may occur from over-stimulation if L-glutamine is taken too close to bedtime.

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**L-Glutamine**

**Capsules** 345

500 mg • 100 capsules

1 capsule contains

L-glutamine ................. 500 mg

Other ingredients: rice flour, magnesium stearate, gelatin, water.

**Dosage and use**

- Take one capsule daily on an empty stomach or as recommended by a healthcare practitioner.

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**L-Glutamine Powder** 141

100 g

1/2 teaspoon contains

L-glutamine ................. 1.95 g

**Dosage and use**

- Mix 1/2 teaspoon in juice or water and take once daily on an empty stomach, or as recommended by a healthcare practitioner.

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**L-Lysine**

Lysine is an essential amino acid needed for growth and to help maintain nitrogen balance in the body. (Essential amino acids cannot be made in the body and must be supplied by the diet or supplements.) It may help promote proper nitrogen balance in the body and prevent glycosylation, the combining of a sugar and protein molecule accelerated by elevated levels of sugar in the blood.

Lysine appears to help the body absorb and conserve calcium. Lysine has many functions in the body because it is incorporated into many proteins, which are used by the body for a variety of purposes.

Most people, including vegans (vegetarians who also avoid dairy and eggs), consume adequate amounts of lysine. However, vegans whose diets contain large amounts of grains and only minimal amounts of beans could become deficient in lysine. Athletes involved in frequent vigorous exercise have increased need for essential amino acids, although most diets meet these increased needs. The essential amino acid requirements of burn patients may exceed the amount of lysine in the diet.

Lysine supplementation increases the absorption of calcium and may reduce its excretion.

Lysine works with other essential amino acids to maintain growth, lean body mass, and the body's store of nitrogen.

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L-Lysine Powder 129
300 g

1 teaspoon contains
L-lysine ..................... 2.6 g

Dosage and use
• One level teaspoon daily on an empty stomach or as recommended by a healthcare practitioner.
• Do not take with arginine supplements.

Retail
Price Each
one bottle $16.00
four bottles $13.75

Member
Price Each
one bottle $12.00
four bottles $10.31

D,L-Phenylalanine Capsules 034
500 mg • 100 capsules

1 capsule contains
D,L-phenylalanine .......... 500 mg
Other ingredients: magnesium stearate, gelatin, water.

Dosage and use
• Take one capsule once or twice daily on an empty stomach or as recommended by a healthcare practitioner.

Retail
Price Each
one bottle $18.75
four bottles $16.00

Member
Price Each
one bottle $14.06
four bottles $12.00

L-Phenylalanine/L-Tyrosine

L-phenylalanine is an essential amino acid which can be converted to L-tyrosine by a complex biochemical process which takes place in the liver. L-tyrosine can be converted by neurons in the brain to dopamine and norepinephrine (noradrenaline), hormones which are depleted by stress, overwork and certain drugs. By replenishing norepinephrine in the brain, mental energy levels are enhanced and a feeling of contentment often occurs. Because of the liver conversion necessary for L-phenylalanine to have these effects, L-tyrosine is often faster acting. In addition, the conversion step from L-tyrosine to norepinephrine may be enhanced if the cofactors (vitamins B6 and C) are included.26,107

Cells in the adrenal medulla synthesize and secrete norepinephrine and epinephrine. Since both norepinephrine and epinephrine can cause smooth muscle (arterial) contraction, care with blood pressure should be taken when supplementing L-phenylalanine or L-tyrosine.

L-tyrosine is also a precursor of two thyroid hormones. D,L-phenylalanine is a 50/50 mixture of its two stereoisomers.

Dosage and use
• Suggested dose is 500 to 1000 mg in the morning or afternoon.
• These products are best utilized when taken on an empty stomach mixed with juice or water.
• Adequate cofactors (vitamins B6 and C) should also be taken if not included with the product.

Caution: Cancer patients should avoid taking L-phenylalanine and L-tyrosine. Certain cancers, such as melanoma, depend on these amino acids to fuel their growth. Supplemental use of L-phenylalanine and L-tyrosine may raise or normalize blood pressure. Insomnia may occur from over stimulation if taken too close to bedtime. Individuals with the rare metabolic disorder Phenylketonuria should avoid phenylalanine.

L-Tyrosine Tablets 326
500 mg • 100 tablets

1 tablet contains
Calcium ...................... 157 mg
L-tyrosine ................... 500 mg
Other ingredients: dibasic calcium phosphate, sorbitol, stearic acid, colloidal dioxide, magnesium stearate, modified cellulose gum.

Dosage and use
• Take one to two tablets daily, between meals on an empty stomach or as recommended by a healthcare practitioner.

Retail
Price Each
one bottle $16.98
four bottles $15.63

Member
Price Each
one bottle $12.74
four bottles $11.72

*These statements have not been evaluated by the Food and Drug Administration. This product is not intended to diagnose, treat, cure, or prevent any disease.
L-Tyrosine Powder 036
100 g

1/4 level teaspoon contains L-tyrosine .......... .920 mg

Dosage and use
• Take 1/4 level teaspoon daily on an empty stomach, or as recommended by a healthcare practitioner. For best results, combine with vitamins B6 and C.

Retail
Price Each $22.50 $20.00
Member Price Each $16.88 $15.00

Taurine Capsules 199
1000 mg • 50 capsules

Taurine is a conditionally essential amino acid produced from cysteine by the body and found abundantly in the body, particularly throughout the excitable tissues of the central nervous system, where it is thought to have a regulating influence. Taurine is also critical for maintaining cardiac health in certain aging individuals. Taurine, however, is deficient in many diets.148-114

1 capsule contains Taurine ......................... 1000 mg
Other ingredients: rice flour, magnesium stearate, gelatin, water.

Dosage and use
• Take one capsule one to four times daily with or without food, or as recommended by a healthcare practitioner.

Retail
Price Each $8.95 $8.00
Member Price Each $6.71 $6.00

Misc. Related Products

Branched Chain Amino Acids 253
90 capsules

The branched chain amino acids L-valine, L-leucine, and L-isoleucine enhance protein synthesis in liver cells and muscle cells.15,116 Because they can be oxidized in the cell's mitochondria, the branched chain amino acids may also provide energy. They are used by body builders to produce an anabolic effect14-120 and repair the microtears that are a normal result of exercise.121-122

4 capsules contain L-leucine .......................... 1200 mg
L-isoleucine ........................................... 600 mg
L-valine ............................................... 600 mg
Vitamin B6 (from pyridoxine HCl) ................... 10 mg
Other ingredients: rice flour, magnesium stearate, gelatin, water.

Dosage and use
• Four capsules on an empty stomach with fruit juice or as recommended by a healthcare practitioner.
• This product is best utilized after exercise or before bedtime.

Caution: This product should not be used by anyone afflicted with the disease pellagra.

Retail
Price Each $19.50 $17.00
Member Price Each $14.63 $12.75

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GABA Powder 127
100 g

GABA (gamma-amino butyric acid) is an inhibitory neurotransmitter, helping neurons stay selective about the signals to which they respond and helping produce a state of relaxation. Taken at bedtime, supplemental GABA may assist some people in the initiation of sleep and produce a deeper and more beneficial sleep.123

1/4 rounded teaspoon contains
GABA ........................................... .700 mg

Dosage and use
• 1/8 to 1/4 teaspoon as required before sleep or as recommended by a healthcare practitioner.
• GABA is most effectively utilized when taken on an empty stomach in juice or water.
• GABA may also be dissolved in the mouth for quicker assimilation.

Caution: Because of its inhibitory neurotransmitter action, it is not advisable to take more than 750 mg.

Retail
Price Each
one bottle $23.75
four bottles $22.50

Member
Price Each
one bottle $17.81
four bottles $16.88

Glycine Caps 795
1000 mg • 100 Capsules

3 capsules contain
L-glycine ......................... .3000 mg
Other ingredients: gelatin, magnesium stearate.

Dosage and use
• Take three capsules at bedtime or as recommended by a healthcare practitioner.
• This product is best utilized when taken on an empty stomach with water or juice.

Caution: If you have kidney or liver disease, have suffered from a stroke, or are taking the antipsychotic drug clozapine, consult a healthcare practitioner before using this product.

Retail
Price Each
one bottle $12.00
four bottles $10.80

Member
Price Each
one bottle $9.00
four bottles $8.10

Glycine

Glycine is a conditionally essential amino acid that serves as an inhibitory and excitatory neurotransmitter. It is the chemically simplest and most ubiquitous of all the amino acids and combines with many toxic substances, converting them to harmless forms which are then excreted.

This amino acid has a calming effect on the brain and is also involved in growth.127-130 Research suggests that glycine may help promote deeper sleep, faster, without the "morning hangover" effect associated with prescription or over the counter sleep medication.131,132 Glycine also has a positive impact on attention and memory in adults.131,132 Glycine may also have bacteria regulating effects.133

Most people need to take between one to three grams of glycine to be effective. However, most glycine products are only available in 500 milligram capsules, which make taking higher doses cumbersome and costly. However, Life Extension's glycine comes in either 1000 mg easy-to-swallow capsules or in powder form.

Retail
Price Each
one bottle $18.00
four bottles $16.00

Member
Price Each
one bottle $13.50
four bottles $12.00

Glycine Powder 128
300 g

1/2 level teaspoon contains
L-glycine ......................... .1400 mg

Dosage and use
• 1/2 level teaspoon per day or as recommended by a healthcare practitioner.
• This product is best utilized when taken on an empty stomach with water or juice.

Retail
Price Each
one bottle $18.00
four bottles $16.00

Member
Price Each
one bottle $13.50
four bottles $12.00

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L-methionine is an antioxidant found in meat and dairy products. In the body, methionine acts as a methyl donor in biochemical pathways and can be converted to SAMe, a natural compound that supports liver function. Supplemental L-methionine is especially recommended for people on a vegetarian diet.

1/4 teaspoon contains L-methionine .............................................. 700 mg

Dosage and use
- 1/4 teaspoon daily mixed with juice or water, or as recommended by a healthcare practitioner.
- Take with small amount of vitamin B6.
- To achieve optimum effectiveness of L-methionine, adequate magnesium should also be taken.

Caution: To prevent accumulation of harmful homocysteine, adequate folic acid, and vitamins B6 and B12 should be taken with L-methionine. Supplementation of TMG (trimethylglycine) will also aid in this process.

Warning: Cancer patients should not take L-methionine because of its tendency to feed tumors.

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