Acetyl-L-carnitine and L-carnitine

What is carnitine?
L-carnitine is an amino acid found in red meat and acetyl-L-carnitine is another form of this nutrient. Carnitine can be made in small quantities by the brain, liver and kidneys. Among other things, this amino acid plays a role in helping to release energy from fat by moving fats to power plants within cells where fats can be burnt as fuel. These cellular power plants, called mitochondria, are responsible for making the energy a cell needs to survive and function.

How does carnitine work?
Carnitine appears to have antioxidant properties. According to at least one study, people with HIV can have normal levels of carnitine in their serum (the fluid part of the blood) while still having very low levels in the cells, where carnitine is needed.

In people with HIV whose health has improved because of anti-HIV drugs (antiretroviral therapy, or ART), carnitine levels may not return to normal.

When taken orally as a supplement, only a relatively small amount—between 5% and 18%—of carnitine is absorbed.

Why do some people with HIV use this supplement?
Carnitine may have several potential uses, including the following:

• to help heal injured nerves—in cases of peripheral neuropathy (PN)
• to decrease levels of lactic acid in the blood
• to reduce higher-than-normal levels of triglycerides

1. To help heal injured nerves

Levels of carnitine in the blood are sometimes lower in people who have HIV and PN (nerve injury that causes tingling, numbness or a burning sensation in the hands, feet and legs), particularly under the following conditions:

• injury from viral infections such as HIV and CMV (cytomegalovirus)
• past use of “d” drugs such as d4T ( stavudine, Zerit), ddl ( didanosine, Videx) and ddC ( Hivid)
• the use of some anti-cancer drugs and antibiotics
• drinking excess amounts of alcohol
• diabetes

What the medications in the above list have in common is that they can injure the energy-producing parts of nerve cells—the mitochondria. Injured mitochondria cannot supply sufficient energy and nerves begin to malfunction and can die. Nerves in the feet, legs and hands, particularly in the skin covering those body parts, appear to be especially susceptible to PN. Some researchers have noticed that people with both HIV and PN can develop abnormal sweating, suggesting that nerves in sweat glands can also be affected.

One formulation of carnitine, acetyl-L-carnitine (ALCAR), may play a role in the management of PN. This compound helps mitochondria function and also appears to enhance the effect of a chemical that helps nerves grow—nerve growth factor.

Researchers in England conducted an extensive and well-designed study of ALCAR in people who have both HIV and PN. Their findings revealed that most people with HIV showed some degree of recovery from nerve damage after taking 1.5 grams of ALCAR twice daily for up to 4 years.

Seventy-six percent of participants had significantly reduced pain. In the British study, analyses of skin samples taken during the clinical trial found that after six months of ALCAR use, injured nerve fibres were undergoing re-growth. The longer participants took the supplement, the greater the re-growth. Nerve fibres grow slowly so it takes many months, perhaps even years, for the injury from PN to heal. Such healing may be incomplete.

There were no significant changes to CD4+ and CD8+ cells or viral load measures during the study.

The research team speculates that ALCAR may have helped nerves for the following reasons:

• Carnitine has antioxidant properties, which may protect nerve cells from the toxicity of the class of anti-HIV drugs known as nucleoside analogues (or nukes).
• By improving the transport of fats and sugar, carnitine may have helped cells become more energetic and active, perhaps stimulating their recovery.
• Carnitine could have helped nerve regrowth and repair by enhancing the effects of nerve growth factor.
• People living with both HIV and PN have been found to have decreased levels of ALCAR in their blood and the supplement may have reversed this.

Overall, this study goes a long way toward helping researchers explore the role of carnitine, particularly ALCAR, as part of the management of PN.

Two randomized, placebo-controlled studies for which participants took 500 mg/day or 1,000 mg/day have also found it to be beneficial in the management of PN in HIV-negative people with diabetes.

2. To help reduce levels of lactic acid in the blood

A rare complication that can occur in users of the anti-HIV drugs called nucleoside analogues is the development of higher-than-normal levels of lactic acid in the blood. If levels become very high, the following cluster of signs/symptoms may occur as part of a condition called lactic acidosis:

• unexpected tiredness
• abdominal pain
• swollen, fatty liver
• shortness of breath
• nausea and/or vomiting
The following blood tests help identify lactic acidosis:

- lactate levels of 5 mmol/L or greater
- bicarbonate levels of 20 mmol/L or lower

If you think that you are experiencing lactic acidosis, contact your doctor right away.

Anecdotal reports suggest that L-carnitine may play a role in helping people with HIV to recover from lactic acidosis. In a pilot study of six people with HIV who were extremely ill and who had high levels of lactic acid in their blood from drug-related side effects, researchers gave them intravenous L-carnitine at doses between 50 mg and 100 mg/kg of body weight per day. Despite this treatment, only three of the participants survived and recovered from lactic acidosis. Other researchers have intervened at earlier stages of lactic acidosis with oral supplements of B vitamins and L-carnitine with successful results.

### 3. To reduce high levels of triglycerides in the blood

In 2001, results of a pilot study in Montreal were released. L-carnitine at a dose of 3 grams daily was used by 16 people with HIV who were also taking anti-HIV drugs. Triglyceride levels decreased significantly within the first month and by the end of the study had deceased by about 35%. By the end of the study, 70% of participants had their triglyceride levels return to the normal range.

In that era, elevated levels of triglycerides in the blood were common because most HIV-positive people taking ART were using a class of drugs called protease inhibitors. Modern protease inhibitors do not usually cause large increases in triglyceride levels.

### Side effects

#### 1. Gastrointestinal

Nausea, vomiting and diarrhea may occur, especially in people who take more than 4 grams per day.

#### 2. Neurological

Seizures have been reported by some people taking carnitine supplements, regardless of whether or not these people had seizures in the past.

#### 3. Thyroid hormones

The hormones produced by the thyroid gland are called T3 (triiodothyronine) and T4 (thyroxine). Thyroid hormones help control the body’s ability to produce energy and regulate its temperature. In lab experiments, L-carnitine blocks the ability of cells to respond to these hormones by interfering with the movement of these hormones within a cell. In studies in HIV-negative people, L-carnitine, at doses of 2 or 4 grams per day, reduced thyroid hormone levels. Researchers are not sure what effect lower doses of carnitine might have on thyroid hormone levels. If thyroid hormone levels fall below normal, a range of symptoms may develop, including the following:

- unexpected tiredness
- feeling cold
- dry skin
- muscle weakness
- forgetfulness and difficulty concentrating
- impaired hearing

If you are taking carnitine supplements, speak to your doctor about monitoring the health of your thyroid gland.

#### 4. Pregnancy

Carnitine has not been studied in pregnant women. Therefore, the manufacturer suggests that carnitine be used by pregnant women only if it is clearly needed.

### Drug interactions

Always tell your doctor and other members of your healthcare team about all the medications (prescription and non-prescription), herbs and
supplements that you are taking. Carnitine may interfere with the following drugs:

- drugs to treat or prevent blood clots—acenocoumarol/nicoumalone (Sintrom)
- thyroid hormones

**Dosage and formulations**

Carnitine is produced by the Sigma-Tau company, in Italy, in two formulations:

- L-carnitine
- acetyl-L-carnitine

The dose usually used in clinical trials varies from 500 mg to 3,000 mg (3 grams) a day. This can be divided into several doses and taken with food.

**Availability**

L-carnitine is sold under the brand name Carnitor and is available by prescription in North America. Acetyl-L-carnitine (ALCAR) is sold under the brand name Nicetile in Italy and some countries of the European Union. In Canada and the United States, some health food stores also sell different brands and formulations of carnitine. All formulations of carnitine are expensive. ALCAR is more often used in studies of neuropathy. Both formulations of carnitine have been used in trials related to HIV, although some HIV nutritional experts have suggested the acetyl form may be more useful.

**References**


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Decisions about particular medical treatments should always be made in consultation with a qualified medical practitioner knowledgeable about HIV-and hepatitis C-related illness and the treatments in question.

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