

# L-carnitine significantly improves patient outcomes following heart attack

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L-carnitine significantly improves cardiac health in patients after a heart attack, say a multicenter team of investigators in a study published today in *Mayo Clinic Proceedings*. Their findings, based on analysis of key controlled trials, associate L-carnitine with significant reduction in death from all causes and a highly significant reduction in ventricular arrhythmias and anginal attacks following a heart attack, compared with placebo or control.

[Heart](#) disease is the leading cause of death in the United States. Although many of the therapies developed in recent decades have markedly improved life expectancy, adverse [cardiovascular events](#) such as ventricular arrhythmias and angina attacks still occur frequently after an acute myocardial infarction (heart attack).

It is known that during ischemic events L-carnitine levels are depleted. Investigators sought to determine the effects of targeting cardiac [metabolic pathways](#) using L-carnitine to improve free fatty [acid levels](#) and glucose oxidation in these patients. By performing a systematic review and meta-analysis of the available studies published over several decades, they looked at the role of L-carnitine compared with placebo or control in patients experiencing an acute myocardial infarction.

L-carnitine is a trimethylamine which occurs in high amounts in red meat and is found in certain other foods, and is also widely available as an over-the-counter nutritional supplement which is claimed to improve energy, weight loss, and athletic performance. Its potential role in

treating heart disease was first reported in the late 1970s.

A comprehensive literature search yielded 153 studies, 13, published from 1989-2007, were deemed eligible. All the trials were comparison trials of L-carnitine compared with placebo or control in the setting of acute myocardial infarction.

This systematic review of the 13 controlled trials in 3,629 patients, involving 250 deaths, 220 cases of [new heart](#) failure, and 38 recurrent heart attacks, found that L-carnitine was associated with:

- Significant 27% reduction in all-cause mortality (number needed to treat 38)
- Highly significant 65% reduction in ventricular arrhythmias (number needed to treat 4)
- Significant 40% reduction in the development of angina (number needed to treat 3)
- Reduction in infarct size

There were numerically fewer myocardial reinfarctions and [heart failure](#) cases associated with L-carnitine, but this did not reach statistical significance.

First author James J. DiNicolantonio, PharmD, Wegmans Pharmacy, Ithaca, NY, observes, "Although therapies for acute coronary syndrome (ACS), including percutaneous coronary intervention, dual antiplatelet therapy, b-blockers (BBs), statins, angiotensin-converting enzyme inhibitors (ACEIs), omega-3 fatty acids, and cardiac rehabilitation, have markedly improved clinical outcomes, adverse cardiovascular (CV) events still occur too frequently after ACS. One promising therapy for improving [cardiac health](#) involves using L-carnitine to improve free fatty acid levels and glucose oxidation."

"The potential mechanisms responsible for the observed beneficial impact of L-carnitine in acute myocardial infarction are likely multifactorial and may, in part, be conferred through the ability of L-carnitine to improve mitochondrial energy metabolism in the heart by facilitating the transport of long-chain fatty acids from the cytosol to the mitochondrial matrix, where  $\beta$ -oxidation occurs, removing toxic fatty acid intermediates, reducing ischemia induced by long-chain fatty acid concentrations, and replenishing depleted carnitine concentrations seen in ischemic, infarcted, and failing myocardium," says DiNicolantonio.

L-carnitine is proven to be safe and is readily available over the counter. The investigators agree that the overall results of this meta-analysis support the potential use of L-carnitine in acute myocardial infarction and possibly in secondary coronary prevention and treatment, including angina. They advocate for a larger randomized, multicenter trial to be performed to confirm these results in the modern era of routine revascularization and other intensive medical therapies following acute myocardial infarction. But, says DiNicolantonio, "L-carnitine therapy can already be considered in selected patients with high-risk or persistent angina after acute [myocardial infarction](#) who cannot tolerate treatment with ACE inhibitors or beta blockers, considering its low cost and excellent safety profile."

These findings may seem to contradict those reported in a study published earlier this month in *Nature Medicine* by Robert A. Koeth and others (Koeth, R. A. et al. *Nature Med.*

<http://dx.doi.org/10.1038/nm.3145>), which demonstrated that metabolism by intestinal microbiota of dietary L-carnitine produced trimethylamine N-oxide (TMAO) and accelerated atherosclerosis in mice. They also noted that omnivorous human subjects produced more TMAO than did vegans or vegetarians following ingestion of L-carnitine, and suggested a possible direct link between L-carnitine, gut bacteria, TMAO, and atherosclerosis and risk of ischemic heart disease.

"The *Nature Medicine* paper is of interest," agrees senior investigator Carl J. Lavie, M.D.,FACC,FACP,FCCP, Medical Director of the Cardiac Rehabilitation and Prevention Center at the John Ochsner Heart and Vascular Institute at the University of Queensland School of Medicine in New Orleans, "but the main study reported there was in animals, and unlike our study, lacks hard outcomes." He also notes that "there are various forms of 'carnitine' and our relatively large meta-analysis specifically tested L-carnitine on hard outcomes in humans who had already experienced [acute myocardial infarction](#)."

**More information:** "L-Carnitine in the Secondary Prevention of Cardiovascular Disease: Systematic Review and Meta-analysis," by James J. DiNicolantonio, PharmD; Carl J. Lavie, MD; Hassan Fares, MD; Arthur R. Menezes, MD; and James H. O'Keefe, MD, *Mayo Clinic Proceedings*, Volume 88, Issue 6 (June 2013), [dx.doi.org/10.1016/j.mayocp.2013.02.007](https://doi.org/10.1016/j.mayocp.2013.02.007)

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