

L-CARNITINE

The shuttle that carries fat to fire.

What the evidence says about L-Carnitine - how it helps cells burn fat for energy, what human studies show, and where the claims outrun the data.

L-Carnitine

Compounded
injectable

1905

year carnitine was first
found, in meat extract

~95%

of the body's carnitine is
stored in muscle

2

building blocks: lysine and
methionine

Essential for burning fat. Modest as a weight-loss tool.

L-Carnitine is a nutrient the body makes from two amino acids, lysine and methionine, and also gets from food, mainly red meat. Its main job is to carry fatty acids into mitochondria, the parts of cells that burn fat for energy.

Most healthy adults make enough. Pooled trials show supplements add a small amount of weight loss, about 1 to 1.3 kg on average. Prescription levocarnitine is FDA-approved for carnitine deficiency; compounded L-Carnitine for weight or energy is not.

KEY FINDINGS

- 1 The fat shuttle.** Long-chain fats cannot enter mitochondria without carnitine.
- 2 Stored in muscle.** Nearly all of the body's carnitine sits in skeletal and heart muscle.
- 3 Small weight effect.** Meta-analyses found about 1 to 1.3 kg more weight loss than placebo.
- 4 Slow to load.** Raising muscle carnitine by mouth took months in one key study.
- 5 Generally well tolerated.** Side effects are usually mild: site discomfort or stomach upset.
- 6 Open questions.** Research on TMAO, a gut byproduct, and heart health is ongoing.

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01 *A ferry across the membrane.*

Mitochondria are wrapped in a membrane that long-chain fats cannot cross on their own. Carnitine **binds to a fatty acid**, carries it inside, and **returns for the next one**. Once inside, the fat is burned for energy.

TRANSPORT

Carries fat in

Moves long-chain fatty acids into mitochondria to be burned.

CLEANUP

Carries waste out

Removes leftover byproducts so they do not build up in cells.

MUSCLE

Fuels work

Heart and skeletal muscle rely heavily on fat for fuel.

WHY "MORE" IS NOT ALWAYS "MORE BURNING"

In healthy people, carnitine is rarely the bottleneck. Fat burning is limited mostly by how much energy you use – movement, activity, and overall calorie balance.

Levels can run lower in some groups, including people on dialysis, those taking certain medicines such as valproic acid, and some people eating strictly plant-based diets. That is where the strongest case for supplementing lies.

"L-Carnitine helps move the fuel. Movement is what burns it."

The Lttl care team

From one injection to fat used as fuel.



Simplified illustration. Effects vary by person. Weight and wellness benefits of compounded L-Carnitine are not FDA-established.

02

Real, but small.

Dozens of trials have tested L-Carnitine for weight and exercise. Most used oral supplements. When pooled, they show a modest extra loss - helpful alongside a plan, not a replacement for one.

Extra weight lost vs. placebo · pooled trials

Mean difference, kg



About 1.2 to 1.3 kg (2.7 to 2.9 lb) more than placebo, on average. The earlier analysis found the effect shrank the longer people took it.

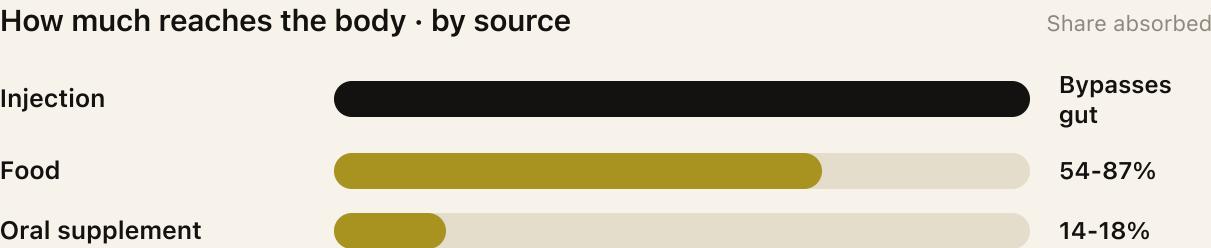
STUDY	WHO AND WHAT	WHAT WAS FOUND
Pooyandjoo 2016	Meta-analysis of 9 trials; adults with overweight or obesity	About 1.3 kg more weight loss than control
Talenezhad 2020	Meta-analysis of 37 trials	Small reductions in weight, BMI, and fat mass; no clear change in belly fat
Wall 2011	14 healthy men; oral L-Carnitine with carbohydrate for 24 weeks	Muscle carnitine rose about 21%; better performance in a cycling test
Fielding 2018	Review of exercise recovery studies	Some reduction in soreness and muscle damage markers
Koeth 2013	Human and mouse studies of gut bacteria	Gut bacteria turn dietary carnitine into TMAO, linked to artery plaque in mice

Most trials tested oral supplements. Few published trials test injected L-Carnitine for weight loss in healthy adults. Long-term outcomes have not been established.

03

Why the route matters.

The gut absorbs only a small share of carnitine from supplements. What is not absorbed can be turned into TMAO by gut bacteria. Injection skips the gut entirely.



Food values come from small daily amounts; supplement values from larger doses, which the gut absorbs less efficiently. Source: NIH Office of Dietary Supplements.

	INJECTABLE	ORAL L-CARNITINE	ACETYL-L-CARNITINE	DIET
What it is	L-Carnitine in a pre-mixed vial	Capsules, tablets, liquids	A related form, often studied for the brain	Red meat, fish, dairy
Digestion	Bypassed	Low absorption	Oral	Well absorbed
Weight research	Limited	Most studied	Limited	Not applicable
Prescription	Yes	No	No	No

04 *Mostly mild. A few to know.*

L-Carnitine has a long safety record, including decades of prescription use for deficiency. Most side effects are brief. A few conditions and medicines call for a conversation first.

Common

Stinging, redness, or tenderness at the site; mild nausea.

Less common

Stomach cramps, diarrhea, or a "fishy" body odor at higher doses.

What helps

Let the vial reach room temperature, inject slowly, and rotate sites.

TALK TO YOUR CLINICIAN FIRST IF YOU HAVE

A seizure disorder. Seizures have been reported in people with a history of them.

Blood thinners. Reports suggest it may raise warfarin's effect; monitoring may be needed.

Heart disease. Research on TMAO and heart risk is ongoing; worth discussing.

Low thyroid. L-Carnitine may blunt thyroid hormone's effects in the body.

Kidney disease. The kidneys clear carnitine; dosing may need care.

Allergy to any ingredient. Stop and seek care for hives, swelling, or trouble breathing.



Pregnancy and breastfeeding. Safety data for compounded L-Carnitine injections are lacking. Tell your clinician if you are pregnant, planning to be, or breastfeeding.

05

Approved for deficiency.
Compounded for wellness.

Levocarnitine (brand name Carnitor) is FDA-approved to treat carnitine deficiency. L-Carnitine for weight or energy support is prepared by compounding pharmacies for individual patients and has not been reviewed by the FDA for those uses.

	LEVOCARNITINE (APPROVED)	COMPOUNDED L-CARNITINE (L TTL)
FDA status	Approved for carnitine deficiency	Not FDA-approved; not reviewed before use
Made by	Licensed drug manufacturers	A state-licensed or FDA-registered compounding pharmacy
Prescription	Required	Required, after clinician review
Format	Tablets, oral solution, IV injection	Pre-mixed liquid vial
Used for	Diagnosed deficiency, including in dialysis	Support alongside a weight or wellness plan; benefits not FDA-established

QUESTIONS TO ASK ANY PROVIDER

- Which pharmacy prepares it, and is it licensed or FDA-registered?
- What is the concentration, and how much is my dose?
- How should I store it, and what is the beyond-use date?
- Who can I reach with questions, and when?

THE DOSING DETAIL THAT MATTERS

L-Carnitine doses are measured in milligrams, and concentrations differ between pharmacies. Always confirm your dose in milligrams **and** the exact syringe marking with your care team, especially with each new vial.

06 *Pair it with movement.*

L-Carnitine moves fat to where it can be burned, but burning it takes activity. The benefit, if any, is most likely when combined with regular exercise and a balanced eating plan.

WEEKS 1-2

Building a routine

Site stinging is most noticeable now and usually eases.

WEEKS 2-8

Settling in

Some notice easier workouts or recovery; many notice little.

MONTHS 2-6

Check in

Muscle stores build slowly. Review progress with your plan.

ONGOING

Review

Reassess benefit and goals with your clinician.

HOW Lttl SUPPORTS TREATMENT

Board-certified clinicians

Licensed providers review your history before prescribing.

FDA-registered pharmacy partners

Prepared by certified U.S. pharmacies and shipped to your door.

Unlimited 24/7 support

Reach the care team any time at (888) 847-7806 📞 or hello@lttl.com.



Where the findings come from.

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IMPORTANT INFORMATION

This whitepaper is educational and does not replace medical advice, diagnosis, or treatment. Study results describe specific populations under study conditions and may not reflect individual outcomes. Most studies cited tested oral L-Carnitine, not injections. Compounded medications are not FDA-approved, and the weight and wellness benefits of L-Carnitine are not FDA-established. L-Carnitine is not right for everyone; discuss your full health history and all medications and supplements with a licensed clinician before starting.

Questions? Talk to our care team.

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Lttl



L-Carnitine
Compounded
injectable
Multiple doses
Rx only