

ERGOGENESIS

ACHIEVING PEAK ATHLETIC PERFORMANCE WITHOUT DRUGS

CARNITINE

by FRED C. HATFIELD PH.D.

Most people probably have never heard of carnitine. I myself previously had seen carnitine mentioned only as a passing reference in an other wise comprehensive textbook. I got the impression that it was a rather obscure, unimportant biochemical substance.

It was during a personal interview with Dr. Guillermo A. Laich of Madrid, Spain, that the subject of carnitine again entered my consciousness. Dr. Laich, one of the foremost experts in sports medicine and human performance, suggested that carnitine, because of its unique biological properties, may play an important role in endurance athletic events. He further stated that carnitine is absolutely essential in cellular fat transport.

How can this mysterious substance, familiar to only biochemists, improve sports performance?

Carnitine was discovered in meat extracts in 1905 by the Russian scientists Gulewitsch and Krimberg. They named it after the Latin word, *carnis*, which means meat of flesh. Because carnitine is 40 times more concentrated in muscle meat as compared to blood plasma, the scientists assumed it played a part in muscular function.

Exactly how carnitine functions in the human body was first hypothesized by Doctors Fritz and Yue. Working with liver cells, they noted that carnitine seemed to act as a fat carrier, allowing fat to be transported into the mitochondria of cells, where it is used as energy.

This discovery has tremendous implications for athletes, because it seems to indicate that carnitine may accelerate the fat oxidation (burning) process. This would lead to lower body fat as well as increased long-term energy substrate for more intense workouts.

There are other health benefits of carnitine. It stimulates the burning of amino acids leucine and

valine, which contribute up to 10% of energy production during intensive exercise. Thus, carnitine may assist in maintaining normal energy output during periods of fasting or reduced intake of fat or carbohydrate, as occurs during strict dieting.

One problem with certain diets involves ketosis, the overprotection of ketones which is the by-product of incomplete combustion of fat. Ketosis is common

FOOD	TOTAL CARNITINE CONTENT
	Mgs/100 Grams
Sheep (muscle)	210.0
Lamb (muscle)	78.0
Beef (muscle)	64.0
Chicken (muscle)	7.5
Lamb (liver)	2.6
Yeast	2.4
Cow's Milk	2.0

during diets that are extremely low in carbohydrates or calories. Large amounts of ketones can be toxic to the brain and nervous system, leading to dehydration as the body attempts to eliminate them through the kidneys. This diuretic effect results in loss of valuable electrolytes such as potassium causing extreme weakness and fatigue.

Working with rats, Dr. Y. Yeh reported in a 1981 issue of the "Journal of Nutrition" that carnitine has an anti-ketogenic effect. If this is confirmed in humans, carnitine may help minimize the effects of fat-burning associated with dieting. Carnitine can be obtained from muscle meats and animal protein foods, and can be synthesized from two amino acids, lysine and methionine. The above chart indicates the natural carnitine content of some selected foods.

Carnitine is virtually non-existent in vegetables and fruits, most strict vegetarian diets are low in the carnitine building blocks of lysine and methionine. Vegetarians risk carnitine deficiency unless the missing nutrients are supplemented in the diet. This possibly explains why most bodybuilders who go on a strict vegetarian diet ("vegans") notice an immediate loss of strength and muscle function. (The lack of vitamin B-12 in these diets also may be a factor.)

In order for carnitine to be synthesized in the body a few accessory nutrients which act as co-enzymes or catalysts must be present. Besides the amino acids lysine and methionine, this process requires Vitamins C, B-6 and niacin as well as iron.

As with amino acids carnitine is found in two basic forms, L-carnitine and D-carnitine. Thus far, the only toxic effect noted with the L form has been a transient diarrhea, which occurred when huge doses were given.

However the D-isomer can be toxic to the body by blocking the cellular uptake of the more useful L form. This can lead to a myasthenia-like syndrome characterized by severe muscle weakness. D-carnitine also inhibits the enzymes which allow L-carnitine to transport fat into the cell, thus inhibiting the fat burning process.

Some health food stores are selling a carnitine product which combined the D and L forms. It is best to avoid this type of product for the reasons stated above.

Carnitine may be valuable in treating certain heart diseases, particularly hardening of the arteries. In Europe, doctors prescribe carnitine for this purpose.

The preferred metabolic fuel of the heart is fatty

acids. By promoting maximal cellular uptake of fats, carnitine may ease the work load of the heart. A large amount of fatty acids at one time can precipitate a fatal heart rhythm disturbance called ventricular arrhythmia. By helping transport fats into the cells, carnitine may help prevent this type of dangerous heart irregularity.

In summary it is apparent that carnitine may enhance several physiological functions relevant to athletes. It plays an essential role in transportation of fat to the cells where it is burned for energy. By promoting maximum cellular uptake of fat, carnitine can improve fat metabolism and possibly aid in lowering bodyfat levels.

Carnitine may allow a more efficient processing of fat, leading to increased energy levels for long term activities such as aerobic exercise and long weight training sessions.

Research indicates that carnitine, coupled with other nutrients, may spare dieters of some of the unpleasant side effects of restricted food intake, such as ketosis.

Unfortunately, L-carnitine, the most useful form of this nutrient, currently is available in only prohibitively expensive forms. However, don't despair! Since the major portion of carnitine can be biosynthesized from other building block nutrients, you can increase your body's supply of carnitine by ingesting generous amounts of the amino acids lysine and methionine, bolstered by iron and vitamins C and B-6.

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LEAN

1 THE START: Head level, eyes straight, hips down, arms locked, spread chest, lower back locked in.

2 THE BEGINNING PULL: Head, eyes and arms the same. Begin lift with legs only. Maintain same back angle. Do not jerk weight off the platform.

3 MIDDLE PULL: Move hips in explosively under shoulders. Do not jerk shoulders and head back. Head, eyes and arms keep the same position.

4 ERECT POSITION: Head straight, eyes level, arms locked, shoulders over hips. Bar moves in a straight line. Do not jerk shoulders and head back.

5 FINAL PULL: Up on toes, fully extend your legs. Do not pull with arms or jerk shoulders back. Bar should continue in a vertical path.

6 THE FINISH: Stand erect, elbows up, bar resting on the deltoids and collar bone.

Stefan Fernholm: 6'-1 1/2", 270 lbs., Squat: 820, Clean: 440, 40:4.3, VJ: 40

For further information on books, videos and clinics, write — **Bigger, Faster, Stronger**, 805 West 2400 South, Salt Lake City, UT 84123 or call toll free 1-800-628-9737