Info 5

News from science and information

EHN
EDER HEALTH NUTRITION

CARNITINE AND GUARANA

THE IMPORTANCE OF CARNITINE AND GUARANA IN SPORTS NUTRITION

Introduction:

Carnitine is a natural component of the food with great importance für the human metabolism. Carnitine enables the burning of long chain fatty acids because they need carnitine as transport system.

Since more than 30 years it is known that a supplementation with carnitine promotes burning fat by heart and liver under certain conditions. However it was about 15 years ago when synthetic and pure L-carnitine became available which gives much better results than the racemic D, L-carnitine used before. The 50 % content of unphysiological D-carnitine partly counteracted the positive effects of the bioactive L-carnitine.

Many types of dietetic nutrition can be optimized by the addition of L-carnitine promoting energy production from fatty acids. Patients with heart insufficiency, pulmonary insufficiency or dialiysis caused carnitine depletion profit from a food supplementation with L-carnitine. Professor BOEHLES, the leading expert in Germany recommends a daily dietary supplementation with 1-3 g of carnitine.

There are some doubts in the literature regarding the advantage of a carnitine supplementation along with sports nutrition or weight reducing diets. However this depends on the fact that carnitine must be given in the right situation and in a right manner. The goal of this information sheet is to show the supplier and user of carnitine when and how carnitine may be used to get the best success.

What is carnitine ?

Carnitine is a molecule similar to amioacids and derived from butyric acid. It is called a „bioactive amine“. It can be synthesized in the body from special amino acids (lysine, methionine). However the greater part of the carnitine in our body is taken up from food. Therefore under a vegetarian nutrition with nearly no carnitine the body carnitine pool declines compared to persons with mixed nutrition. The name „carnitine“ is devived from the latin name for meat because this is by far the main source for carnitine in food. A high content of carnitine is found in the meat of goates, lambs and some other wild animals (up to 2000 mg/kg). The highest content was reported for fresh ice sea crabs with up to 9000 mg/kg. That means that 1000 mg of carnitine may be provided by eating only 110 g fresh crabs of arctic origin.

How does carnitine work ?

L-carnitine is used to transport the free fatty acids from fat to that place within the cells where they can be oxidized (burned). Only the mitochondria in the cells have the special enzymes necessary for the burning of fatty acids. To reach this place the free fatty acids have to cross two cell membranes: the outher cell membrane and the membrane of the mitrochondria within the cells. L-carnitine binds with one fatty acid thus forming a slightly polar molecule which can pass cell membranes. Within the mitrochondria the fatty acid is set free and can be burned at the enzyme rich structures of mitochondria. This results in energy as ATP.

If the fatty acid is not burned in the mitrochondria it reversly can be transported out of the cell. This can take place especially in the following situations:

1. The cell needs less energy than can be formed by burning the fatty acids. This may be if the muscle is not active or not active enough.
2. The cell needs much energy but the capacity of the oxidizing enzymes is to low to burn all the fatty acids. This situation is typical for sportsmen with an untrained fat metabolism (training too short or wrong which means too high intensity or too high carbolydrate intake).
3. The cell needs much energy but a high intake of carbohydrates blocks the fatty acid oxidation due to the so called RANDLE mechanism. This situation will occure if a sportsmen takes carbolydrates immediately before the endurance or in the early phase of the work load. Here high concentrations of insulin are provoced blocking enzymes of fat oxidation.

Conclusion:

In all three situations the burning of fatty acids cannot be enhanced by carnitine supplementation because the availability of falty acids in the mitrochondria is not the limiting step. Most of the disappointing results of scientific studies therefore are the result of wrong test conditions. It is the truth that many investigators did not understand how carnitine works and thus could not find the advantage of a carnitine supplementation.

If one wants to promote the burning of fat he has to take care that the transported fatty acids find adequate conditions to be burned.

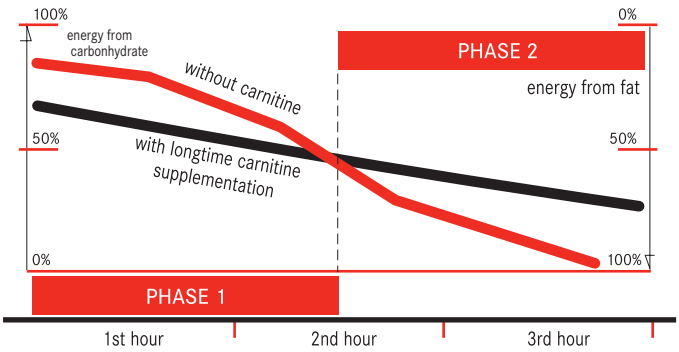
What is the conclusion for the use of carnitine supplements ?

If somebody wants to activate his fat metabolism with carnitine he should know the following rules:

1. Carnitine will activate the burning of fat only in case of a proper energy consumption by the body. For a dominating fat metabolism it is important to have a training of quite low intensity and long duration. For fitness sportsmen this means to have a work load equivalent to about 40 - 50 % of the maximum work load and to do this for at least 1 - 2 hours continously. During such a training there is a moderate sweating only! A higher intensity of work load would shift the energy meabolism towards carbolydrate combusition. This would reduce the fat burning in spite of a higher energy production. A training intensity of less than 40 % VO2max is unrealistic because a very long training time will be necessary in this case (for instance many hours of mountain walking).
2. Start your training always with empty stomach and without carbohydrate consumption for at least 5 hours before you start. The best way is to cancel the last meal before the training or to have a meal with very low carbolydrate content.
3. Do not use carbohydrate rich drinks or food before and during your endurance training. Avoid so called snacks or bars. Use light sports drinks with not more then 4 % carbolydrate content during the training (Mineral Drink light).
4. Have a consequent training program under the mentioned conditions for at least 3 times per week and at least 2 hours each. Such a training program will elevate the capacity to oxidize fat. This means also that you can have higher work load without shifting into a dominating carbohydrate combustion.

With these rules by each training hour about 50 g of fat can be burned at the start of the program. After 3 months you will be able to burn up to 100 g of fat per hour!

Effect of a fat metabolism training and carnitine supplementation
(case of a 3 hour marathon training)



Advantage of a shift of energy production to burning fat:
phase 1 - less consumption of glycogen, less production of lactate and more consumption of fat with unchanged power.
phase 2 - carbohydrate and fat are burned simultanuosly due to higher glycogen stores in this important phase. This result is more endurance while other competitors are in the situation of declining energy (insider says „hit the wall").

How to use the carnitine supplements:

The use of carnitine will be of increasing importance if you have increased the capacity to burn fat. During the first weeks of a fat metabolism oriented training program the initial pool of natural carnitine in your body may be sufficient to transport the fatty acids into the cells. However after about four weeks of training the pool of carnitine may became energy limiting and this is the time when carnitine supplementation becomes important for your further training and for competition of course.

How much carnitine should be taken ?

The present knowledge of sports nutrition physiology is that 1000 mg carnitine per day are sufficient for a fitness oriented sportsmen. This amount should be taken up in two portions to have a better bioavailibility of the carnitine.

For high performance endurance sportsmen 3000 mg per day during training and up to 5000 mg during periods of competition seem to be adequate. This amount should be taken irrespectively from the work load of a day because the increase of the carnitine pool of the body is a process of several weeks.

How a carnitine supplement should be composed

A carnitine supplement usually contains about 300, 500, 1000 or 1200 mg of pure L-carnitine (calculated as base). To get an acceptable taste an acidic component must be used. For sports nutrition the acid must be metabolized in the body, so friut acids like citric acid, malic acid or tartaric acid are recommended. (Never use a product containing carnitine as a salt of hydrochloric acid. This may acidify the muscle and reduce endurance!)

Considerations for long time endurance sports:

For endurance over 2 hours or more (marathon, triathlon) it is very important to save the glycogen stores to have enough glucose for the whole time. Some decades ago it was recommended to maximize the glycogen stores by high carbohydrate loads after a glycogen depleting training (SALTIN diet). However too high glycogen stores harden the muscle and may reduce endurance.
Today a moderate carbohydrate loading in combination with a long time carnitine supplementation and a special training of fat metabolism is the superior method enhance endurance and power. The high rate of energy production from fat helps to body to save important amino acids from combustion. So the use of carnitine may prevent an amino acid depletion thereby shortening the time necessary for regeneration after the work load.
This is in congruence with the observation of UHLENBROCK (1992) (university of Cologne) that carnitine promotes the immunity of exhausted sportsmen which usually is deminished by amino acid depletion and other factors.

Carnitine and weight reducing diets

A well planed low energy diet for weight reduction may provoke a daily weight loss of about 200 g over a longer period in persons with healthy metabolism. However it is very important to provide the body with all essential nutrients in adequate amount (minerals, trace elements and vitamins). For commercial diets there is a very strict regulation in Europe to ensure a minimum supply of these nutrients. In the case of simple reduction of food the essential nutrients must be provided by supplementation. This is important to maintain the ability of the body to burn fat and to avoid immune depletion and weakness. An additional moderate training to the weight reducing diet may help to increase the weight loss to 300 - 400 g per day without loss of muscle mass. In this case the supplementation with 1000 mg carnitine will be helpful. In Germany therefore the addition of 1000 mg carnitine to commercial weight reducing diets is officially permitted by a decret of the Federal Ministry of Health (12-05-1996) and by the EU committee „EFSA" legalized at least 2 g per day.

Carnitine supplements are food in Germany and Europe

Carnitine supplements for the use described in this paper are given for nutritional purpose only. No pharmacological actions are intended or even possible. So these carnitine supplements are food products in the legal form of food supplements, dietetic food for sportsmen or dietetic food for weight reduction. There is absolutely no risk for health when using carnitine supplements at least up to 8 g per day. However not more than about 1000 - 1200 mg should be taken at one time to avoid unnecessary carnitine losses by urine and stool. The European Food Commission „EFSA" published the statement that at least up to 2 g carnitine per day is typically for food and is lifelong safe.

The utility of Guarana for Sports and Fitness

Guarana is plant of the Brazilian rain forest. The brown seeds are used to promote work endurance of the inhabitants of this region for many thousend years. 1926 caffeine was found to be the main substance responsible for the biological activity of Guarana. In Guarana seeds the caffeine is strongly bound to tannic acid. Therefore the caffeine is set free quite slowly to enable a mild but efficious promotion of working capacity. The amount of Guarana produced is quite small and can hardly be extended. Therefore Guarana is a precious natural and healthy product.

If used in the nutrition for sports and fitness Guarana has important advantages:

1. Guarana activates without exitement. It promotes the physical and mental (intellectual) capacity. In sports Guarana helps to maintain the complex coordination of movements thereby promoting endurance with less risk of accidents.

2. Guarana by its coffeine content promotes the production of energy from fat burning (by facilitated lipolysis). This may save glycogen and helps to finish a long lasting work load with a sufficient glucose supply for muscle and brain.

3. Guarana like other plants containing caffeine and tannic acids (like tea) reduces hunger feeling. This makes it easier to maintain a training (or weight reducing diet) without unnecessary food uptake.

For an endurance sportsmen this helps to train the fat metabolism. In sportsmen training for fitness and weight reduction Guarana helps to avoid a high food intake after the training. Without Guarana it is quite often seen that people have a great hunger and eat more calories than they have lost by the training.

Guarana usually is used as a dark brown extract standadizied on a caffeine content of 10 %. 1 g of this extract therefore contains 100 mg of caffeine which is equivalent to the caffeine content of one cup of coffee as used in Europe.

According to the doping rules of the olympic committee the use of caffeine is no longer limited in sports.

Conclusion:

Guarana is a powerful and healthy activator for many situations with a typical nice bitter taste. However consider that Guarana never can replace a good training. The same is true for carnitine: no result without physical activity!

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