

L-Carnitine for your skin

Ulla Held
Lonza AG, Muenchensteinerstr. 38, 4002 Basel, Switzerland

Increasing consumer concerns about health have triggered growing demand for cosmeceutical products. Cosmeceuticals now represent up to 50 per cent of supplement sales in some countries. The category is estimated to be worth €3.5 billion globally and one of the biggest areas of innovation in the wider nutraceuticals sector. In order to meet consumers' needs and to capitalize on this expanding market, the ingredients used must be chosen with safety, efficacy and quality in mind. The successful introduction of a cosmeceutical can also be enhanced when consumers already recognize the health-enhancing ingredient and especially when the ingredient's health-promoting benefits are easily understood. With the above in mind, **L-Carnipure® L-Carnitine** can be viewed as a winning ingredient in cosmetic applications.

The cosmeceuticals market is based mainly on skin care, hair care and sun care. Products in the skin care market include those for anti-aging, anti-wrinkle, skin lightening, and cellulite reduction. "The most promising market sector from both a technological and financial viewpoint is skin care cosmeceuticals, which comprises over half the total cosmeceuticals market," says Jennifer Sizemore, senior research associate at Technology Catalysts International, a Virginia-based consultancy. "The cosmeceuticals market, particularly skin care, continues to grow at about double the pace of the cosmetics and toiletries market in the US." This reflects the need of an aging population for more effective appearance-enhancing and age-defying skin cosmetics.



What is L-Carnitine?

L-Carnitine is a naturally occurring, amino acid-like substance that can either be produced by the body or obtained through the diet. Initial interest in L-Carnitine focused on its use as a vital nutritional supplement. In the body, one of the most fundamental roles of L-Carnitine is the transport of long chain fatty acids across the mitochondrial membrane into the mitochondria, where the fatty acids are ultimately broken down and converted to energy. L-Carnitine is therefore essential for fat metabolism and energy production. L-Carnitine has been a globally established dietary supplement for many years now, and is also enjoying increasing popularity as a functional food ingredient. L-Carnitine has been observed to increase the VO₂ max (maximum achievable aerobic power) in endurance athletes, presumably by increasing fat breakdown. Utilizing fat in working muscles has the effect of sparing glycogen, thereby delaying exhaustion and enhancing performance. L-Carnitine has also been

observed to alleviate delayed onset muscle soreness (DOMS). It is widely accepted that L-Carnitine has significant cardioprotective properties and can also be useful as part of a weight management programme when combined with exercise and calorie restriction. The latest research reveals that L-Carnitine has beneficial effects on the physical and mental well-being of elderly people.

First applications of L-Carnitine in cosmetics

The skin is one of the largest organs in the body. It has an average surface area of 1.8 m² and makes up approximately 16% of our body



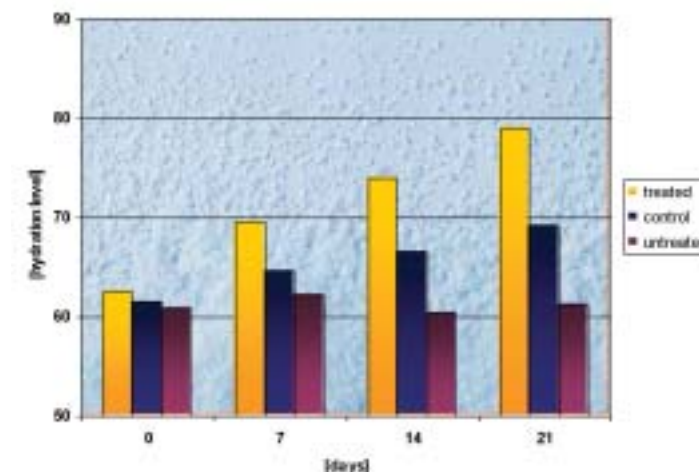
weight. In the first place, the skin acts as a barrier to physical agents and protects against mechanical injury. It also prevents the dehydration of the body through fluid loss, reduces the penetration of UV radiation, helps regulate body temperature and acts as a sensory organ. The skin is closely associated with cosmetics. Given L-Carnitine's ability to play a major role in fat breakdown, it is not surprising that one of the substance's first cosmetic applications was in contouring creams and cellulite control formulations. Recently however, attention has focused on the beneficial effects of L-Carnitine on the skin itself. A study established that L-Carnitine prevents and alleviates deleterious skin conditions such as varicella scarring, wrinkle formation and sunburn peeling. The further benefits of L-Carnitine to the skin are discussed below.

Hydrating power of L-Carnitine

Since L-Carnitine is hygroscopic, even small amounts are able to hydrate the skin, leaving it soft, smooth and moisturized. A human panel test was carried out, in which sites on the forearms of the panelists were either untreated, treated daily with a placebo formulation, or treated daily with a formulation containing 2% L-Carnitine. Corneometer readings were then taken at each site to determine hydration levels. The data shown in Figure 1 clearly demonstrate the hydrating power of L-Carnitine in cosmetic formulations. The hydration level of skin treated with L-Carnitine increased by 26.4%, compared to 12.5% for the skin treated with placebo. As expected, the hydration level of the untreated skin did not change significantly.



Figure 1: Hydrating power of L-Carnitine in cosmetic formulations



Influence of L-Carnitine on epidermal turnover rate

The ability of exfoliating α -hydroxyacids such as glycolic and lactic acids to accelerate the turnover rate of skin cells is well known. Similarly, L-Carnitine, a β -hydroxyacid exhibits excellent skin exfoliating properties, even at low levels. This exfoliating effect manifests itself as acceleration in epidermal turnover rate. In healthy skin, the outermost cells in the horny layer are constantly being sloughed off and replaced by new cells generated in the basal layer of the epidermis. The time needed by a new generation of cells to travel from the basal to the upper horny layer is the epidermal renewal time. When the equilibrium of the skin is altered, dead cells tend to accumulate in the outer layers, the turnover rate declines and the renewal time increases. As we age, the time required for skin renewal also increases. In young and middle aged adults the renewal time is approximately 20 days, whereas in adults over 50 the rate of turnover slows and the renewal time increases to approximately 30 days. Removing the dead skin cells and increasing the rate of skin turnover typically results in younger and healthier-looking skin. The rate of skin turnover is generally determined by the time that it takes for skin treated with a fluorescing dye to lose its fluorescence. In-vivo determination of turnover time, in which the dye was applied to the forearms of human volunteers followed by topical treatment with either a placebo (cream vehicle) or a cream containing 2% L-Carnitine for a period of 28 days, clearly shows that application of L-Carnitine does indeed accelerate skin turnover. The results are outlined in Figure 2. In the trial, skin was renewed after an average of 18 days with L-Carnitine treatment and after 21 days with placebo treatment, whereas untreated skin required 23 days. This is equivalent to a 12% increase in epidermal turnover rate

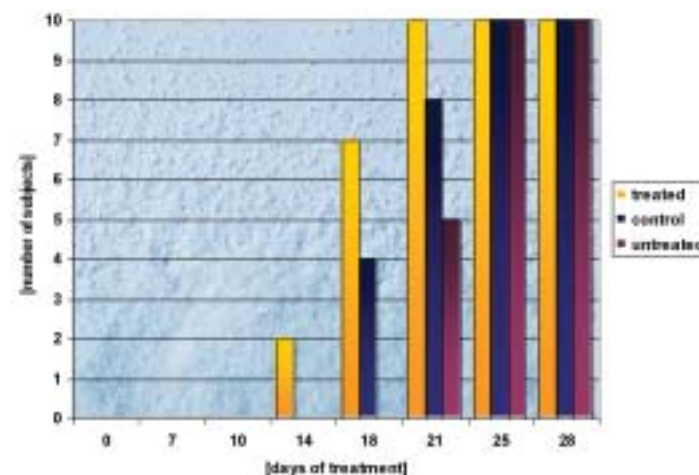


Figure 2: L-Carnitine increases skin renewal time

Quality of L-Carnitine

Carnitine, like many biologically active molecules, exists in two forms: L-Carnitine and D-Carnitine. L-Carnitine is a physiological substance, and has a host of applications, ranging from approved pharmaceutical indications and nutritional supplementation to animal feed formulations. In contrast, D-Carnitine, as a pure substance or in the form of racemic DL-Carnitine, has been found to be not only physiologically inactive, but also to inhibit the uptake and functions of the natural isomer L-Carnitine. Serious side effects to human health have been observed with racemic DL-Carnitine, and in consequence the US FDA issued an Import Alert for DL-Carnitine in 1984, effectively banning the use of DL-Carnitine in the USA. For large-scale production of Carnitine, however, there are essentially two different synthesis pathways in use at the present time: the chemical preparation of DL-Carnitine, with subsequent separation of the D- and L-isomers using an optically active resolving agent, and the synthesis of pure L-Carnitine using a biotechnological approach. However, only the second method guarantees production of optically pure L-Carnitine containing 0% D-Carnitine. This process is unique and Lonza holds a worldwide patent for the biological production of L-Carnitine. Since all other chemical production processes yield L-Carnitine of a lower optical purity, traces of some undesirable D-Carnitine cannot be avoided.

The major advantages of using L-Carnitine, which occurs both in the human body and in food, in cosmetics, are summarized below:

- L-Carnitine already has a positive and healthy image
- Due to the high level of name recognition, it is very easy to promote and advertise products containing this ingredient
- L-Carnitine is GRAS (Generally Recognised As Safe) as a food ingredient. Such substances normally require far less toxicological data for use in cosmetics.



Lonza, the leading manufacturer and supplier of the raw material L-Carnitine, is the only supplier that can guarantee 100% pure, natural L-Carnitine – totally free from harmful D-Carnitine. L-Carnipure® and the L-Carnipure®-logo are registered trademarks of Lonza.

In summary

L-Carnitine is a natural endogenous material that is vital for the metabolism of fats in the body. Utilizing a patented biotransformation process that guarantees high purity, L-Carnitine manufactured by Lonza and sold under the L-Carnipure® trade name contains 0% of the D isomer. It is therefore approved for food use and enjoys GRAS status.

At neutral pH, L-Carnitine exists as an internal quaternary salt. On skin, this highly hygroscopic material exhibits a pronounced moisturizing effect, making it a useful addition to various moisturizing creams and lotions.

As a lower-pH β -hydroxyacid, L-Carnitine exhibits exfoliating properties and the ability to significantly reduce skin turnover time, making it an ideal candidate for reparative exfoliating creams and lotions in which it can either be used alone or in conjunction with other hydroxyacids, i.e. glycolic or lactic acids.

Therefore, apart from being a food supplement, L-Carnitine is a natural, endogenous, multifunctional, and versatile ingredient for use in the skin care segment and can be used in a wide range of personal care applications.

About the Author:

Ulla Held is Manager of Scientific Affairs for Lonza, suppliers of L-Carnipure® L-Carnitine products to nutritional, food and pharmaceutical companies worldwide. She has a diploma in Nutritional Sciences from the University of Hohenheim, Germany. For further information, she may be reached via email: ulla.held@lonza.com