

Effects & Benefits of Amino Acids for the Skin

The medical and cosmetic effects and functions of 12 amino acids for the skin are summarized.

1) L-Arginine

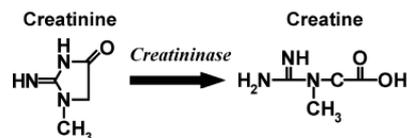
Research suggests that the amino acid accelerates the rate of the healing of wounds [1, 2].

The vasodilating effect of arginine promotes hair growth [3].

From: <http://www.aminoacid-studies.com/areas-of-use/anti-aging.html>

2) Carnitine / Creatine

The naturally-occurring, chemical compound carnitine is not an amino acid. But a dipeptide made from the essential amino acids lysine and methionine. The dipeptide creatinine is hydrolyzed by the enzyme creatininase to creatine.



From [4]

Creatine supports skin functions and stimulates collagen production and plays an important role for healthy skin. Creatine together with folic acid improves the firmness of the skin and acts against aging symptoms [5]. Creatine is produced from the amino acids arginine and methionine, which are in turn a part of carnitine. Creatine supports skin functions and stimulates collagen production.

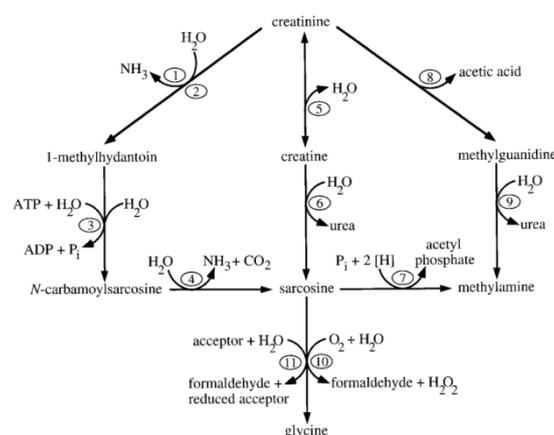


FIG. 7 . Schematic representation of the reactions and enzymes involved in microbial Cr and Crn degradation pathways. The respective enzymes are denoted by numbers: 1) creatinine iminohydrolase (creatinine deaminase; EC 3.5.4.21); 2) cytosine aminohydrolase (cytosine deaminase; EC 3.5.4.1); 3) 1-methylhydantoin amidohydrolase [ATP dependent (EC 3.5.2.14) or non-ATP dependent]; 4) *N*-carbamoylsarcosine amidohydrolase (EC3.5.1.59); 5) creatinine amidohydrolase (creatininase; EC 3.5.2.10); 6) creatineamidinohydrolase (creatinase; EC 3.5.3.3); 7) sarcosine reductase (EC 1.4.4.-); 8) not

characterized so far; 9) methylguanidine amidinohydrolase (EC 3.5.3.16); 10) sarcosine oxidase (EC 1.5.3.1); 11) sarcosine dehydrogenase (EC 1.5.99.1) or dimethylglycine dehydrogenase (EC 1.5.99.2) **From** [1] .

3) L-Glutamine

Glutamine regulates the **acid-base balance and makes the skin firm**. Glutamine plays a decisive role in keeping a balanced acid-base ratio.

Pyroglutamic acid (PCA), a derivative of glutamine, acts as a moisture binding compound allowing the stratum corneum to remain hydrated at low environmental humidities [6, 7]. Topical application of L-glutamic acid, L-aspartic acid (non-specific glutamate receptor agonists) and N-methyl-D-aspartate (NMDA, NMDA type receptor agonist) delayed the barrier recovery rate after barrier disruption with tape stripping. Glutamate plays an important role as a signal of cutaneous barrier homeostasis and epidermal hyperplasia induced by barrier disruption [8].

Acute disruption of the barrier results in an increase in epidermal DNA synthesis and cytokine production [9, 10]. Even when the damage of the barrier is relatively small, when it is repeated or under low environmental humidity [11, 12]: Low humidity stimulates epidermal DNA synthesis and amplifies the hyperproliferative response to barrier disruption [11]), the damage induces an obvious epidermal hyperplasia and inflammation. Moreover, various kinds of dermatoses, such as atopic dermatitis, psoriasis and contact dermatitis, are associated with barrier dysfunction [13].

During normal acid-base balance, the small intestine and the liver are the major sites of glutamine utilization. The periportal hepatocytes catabolize glutamine and convert ammonium and bicarbonate ions to urea. During metabolic acidosis, the kidney becomes the major site of glutamine extraction and catabolism. This process generates ammonium ions that are excreted in the urine to facilitate the excretion of acids and bicarbonate ions that are transported to the blood to partially compensate the acidosis [14].

4) L-Glycine

Glycine decreases oxidative stress and acts as an antiinflammatory, immunomodulatory, and cytoprotective agent [15]. glycine acts in the central nervous system as inhibitory neurotransmitter. As there is a functional glycine receptor expressed in keratinocytes, the topical application of glycine on hairless mice skin after a barrier disruption accelerated the barrier recovery [16]. Even more, Glycine regulates the epidermal barrier homeostasis and thereby is leading to an acceleration of skin repair [17].

5) L-Histidine

Shampoo and cleansers containing anionic surfactants including sodium dodecyl sulphate (SDS) often cause pruritus in humans. Treatment with SDS increased the histamine content of the epidermis, but not that of the dermis. SDS treatment increased the gene expression and post-translation processing of L-histidine decarboxylase in the epidermis. A frequently reported subjective symptom in surfactant users is itching [18]. Itch-induced vigorous scratching damages the skin, causing irritation and dryness that worsen cutaneous lesions and increase itch. Repeated SDS application to murine skin