Glutamine

Summary
Glutamine is an amino acid that becomes conditionally essential during times of severe illness or injury. It is formed when glutamate accepts an extra amino group from other amino acids. Glutamine is part of most proteins and can also be thought of as a natural active nitrogen reservoir. The best available evidence for improved outcome for glutamine supplementation is for patients with severe burns.

Chemical form and metabolism
Glutamine (Gln) is a neutral amino acid with a linear carbon chain and a second amino group at the end of the chain. The free amino acid is very unstable in solution. Gln tends to lose an amino group and form a ring (cyclical deamidation) during heat sterilization or storage of liquid products.

Functions
Gln is the most abundant free amino acid in tissues, blood, and human milk. One may think of the molecule as a natural active nitrogen reservoir. It is formed when glutamate accepts an extra amino group from other amino acids. Gln can release this extra amino group as ammonia, which helps with the regulation of pH particularly in the kidneys. The extra amino group is also used for the synthesis of urea, amino acids, nucleotides, amino sugars, and glycoproteins. Of course, Gln is also part of most proteins.

Major dietary sources
Proteins in foods of both plant and animal origin provide significant amounts of Gln. There are no relevant differences in the Gln content of specific foods.

Clinical Uses
Supplemental Gln is sometimes used to support metabolism and protein synthesis in patients after major surgery, severe trauma or burns, systemic infections, and other severe illness.¹ The key rationale is that in such situations the body cannot meet the extremely high demand and providing a supplement will correct this imbalance. The extra Gln also appears to suppress key inflammatory mediators, including interleukin 6, tumor necrosis factor alpha, and nitrous oxide.² However, the ability of supplemental Gln to reduce mortality of many types of critically ill patients remains in doubt for most patients.³,⁴ Probably the best evidence for a possible supplement benefit exists for severely burned patients, suggesting reduced infection with gram-negative bacteria, and most importantly, reduced mortality.⁵

Added Gln may help to reduce burdensome chemotherapy and radiation effects on the vulnerable mucosa in the mouth.⁶ Such supplements have also been suggested to protect against paclitaxel-induced peripheral neuropathy, but the effectiveness of this approach is in doubt.⁷

Gln supplements are used extensively to enhance muscle mass and performance in recreational and competitive sports. Current trial evidence does not support the effectiveness of such use.⁸
Potential Side Effects

Large amounts of supplemental Gln add to the ammonia load in patients with liver dysfunction and can harm brain health in the long term.\(^9\) Carriers of a genetic defect in the urea cycle (rare, in less than 1 of 15,000) may be at acute risk from the toxic effects of ammonia accumulation.\(^10\) Individuals with glutamate sensitivity (migraine) usually do not tolerate Gln supplements well, but will quickly learn to avoid the products. It also has been suggested\(^11\) that supplemental Gln may trigger episodes of mania, hypomania or epileptic seizures, but the evidence for such effects is extremely sparse.

Practical Significance

Supplemental Gln is not likely to improve survival of critically ill patients. The best evidence for improved outcome is available for patients with severe burns. The earlier high expectations for benefits in other critically ill patients were not met. There may be some benefit for protection against oral mucositis due to cancer therapies. Users of Gln-containing sports supplements will probably be disappointed with the results.

References