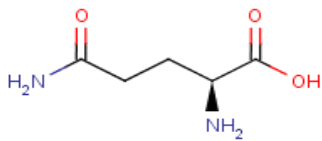


## L-Glutamine Pure Powder

### TECHNICAL SUMMARY

L-glutamine, the most abundant amino acid in the body, is an important constituent of proteins and participates in many key metabolic processes.\* Glutamine helps to regulate acid/base balance, maintains nitrogen balance, and acts as a nitrogen reservoir for the production of other amino acids.\* It also serves as an important energy source for certain cell types, such as gut, immune, and kidney cells.\* Glutamine is known to support gastrointestinal integrity, normal immune system function, and the preservation of muscle tissue.\*

#### Structural Formula:



**Chemical Name:** (S)-2,5-Diamino-5-oxopentanoic acid

**Allergen and Additive Disclosure:** Not manufactured with wheat, gluten, soy, milk, egg, fish, shellfish or tree nut ingredients. Produced in a GMP facility that processes other ingredients containing these allergens.

**Delivery Form:** Pure Powder

### ROLE AS NUTRIENT/FUNCTION

Glutamine is present in abundance throughout the body and is used for the synthesis of proteins, peptides, amino acids and nicotinamide adenine dinucleotide phosphate (NADP).\* It is the principal carrier of nitrogen in the body and is an important energy source for many cells.\* L-glutamine also has immunomodulatory properties and is the preferred source of energy for rapidly dividing cells such as enterocytes.\* It regulates gene expression and cell signaling, and is necessary for ammonia detoxification.\*

### NATUROKINETICS®

**Liberation:** This product is a pure powder and can therefore be readily used by the body.

**Absorption:** L-glutamine is absorbed rapidly, predominantly in the small intestine. The estimated uptake of glutamine after oral administration varies according to oral dose from 57 to 84%.

- In a pharmacokinetic study, six healthy male volunteers were randomly assigned to receive 0, 0.1, or 0.3 g/kg of glutamine. Plasma levels were assessed over a 4 hour period. Plasma glutamine concentration peaked at 30-45 minutes ( $T_{max}$ ) with a steady decline to normal ranges in 90-120 minutes (low dose) and 180-240 minutes (high dose). Peak concentration ( $C_{max}$ ) was 1,028±97  $\mu$ M and 1,328±99  $\mu$ M, respectively (Figure 1).
- In a pilot pharmacokinetic study in healthy adult volunteers, a single oral administration of five capsules of Extra Strength L- Glutamine 1,000 mg (P0094, Protocol For Life Balance®) resulted in  $T_{max}$  of 1

## Supplement Facts

Serving Size 1 Rounded Teaspoon (approx. 5 g)  
Servings Per Container about 91

#### Amount Per Serving

L-Glutamine (Free-Form) 5 g (5,000 mg)\*

\* Daily Value not established.

Other ingredients: None.

◆ Supports a Healthy Immune System\*

◆ Promotes Gastrointestinal Health\*

**SUGGESTED USAGE:** Mix 1 rounded teaspoon in water or juice, preferably between meals, 1 to 2 times daily as needed, or as directed by your healthcare practitioner.

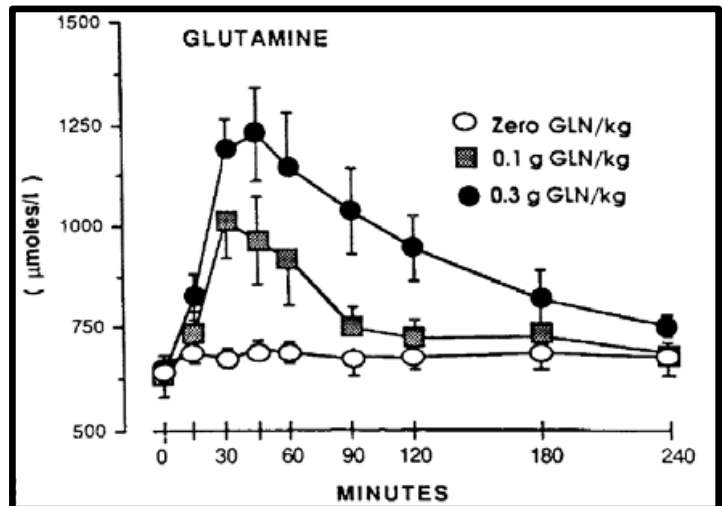


Figure 1. Whole blood glutamine concentrations following oral L-glutamine loading in healthy male volunteers.

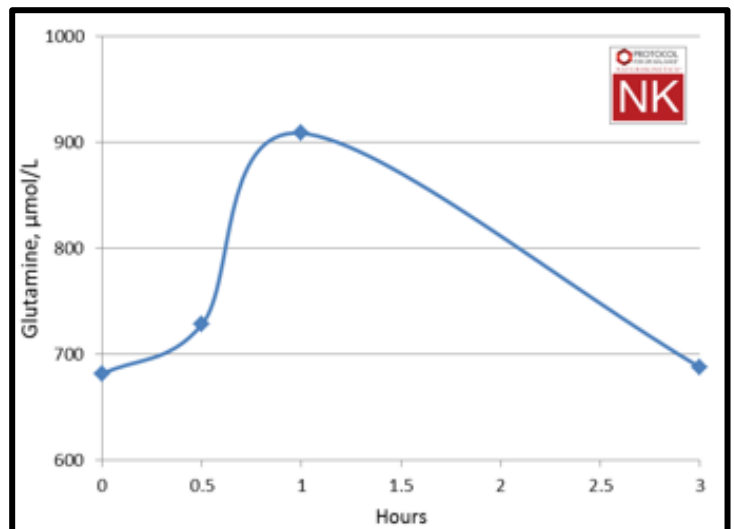


Figure 2. Average serum glutamine levels following a single administration of 5 g of L-Glutamine (Protocol for Life Balance®, Product Code #P0094, 5 capsules) in healthy adult volunteers.

hour, and the plasma concentration of free glutamine returned to the baseline 3 hours after administration (Figure 2).

**Metabolism:** L-glutamine can be directly utilized by enterocytes to produce amino acids (citrulline, arginine, ornithine, proline, alanine) and energy. The end products of glutamine metabolism in enterocytes include amino acids, lactic acid,  $\text{NH}_3$  and  $\text{CO}_2$ .<sup>\*</sup> Systemically absorbed glutamine can be incorporated into proteins and peptides, can become a precursor of glutamate or ammonia, or can be used in the production of energy or for gluconeogenesis in the kidneys/liver.<sup>\*</sup>

**Distribution:** Glutamine produced by the body is stored in muscle tissue in large amounts. Glutamine is also produced by the body in lung, liver and adipose tissues. Glutamine provided by food/supplements and endogenous glutamine is used in the liver, gut, immune system, kidney and central nervous system.

**Elimination:** In human pharmacokinetic trials, the average half-life ( $t_{1/2}$ ) of glutamine is 110 minutes, with a predominant route of excretion via urine.

### CLINICAL VALIDATION

- Immune System Support:**<sup>\*</sup> In a randomized, double-blind, placebo-controlled study, 24 healthy and highly trained athletes were supplemented with 10 g of glutamine daily for three weeks. Compared to placebo, glutamine supplementation had a significant impact on several markers of immune function, including the percentages of specific types of circulating immune cells involved in adaptive immunity, and the activity of immune cells involved in innate immunity.<sup>\*</sup>

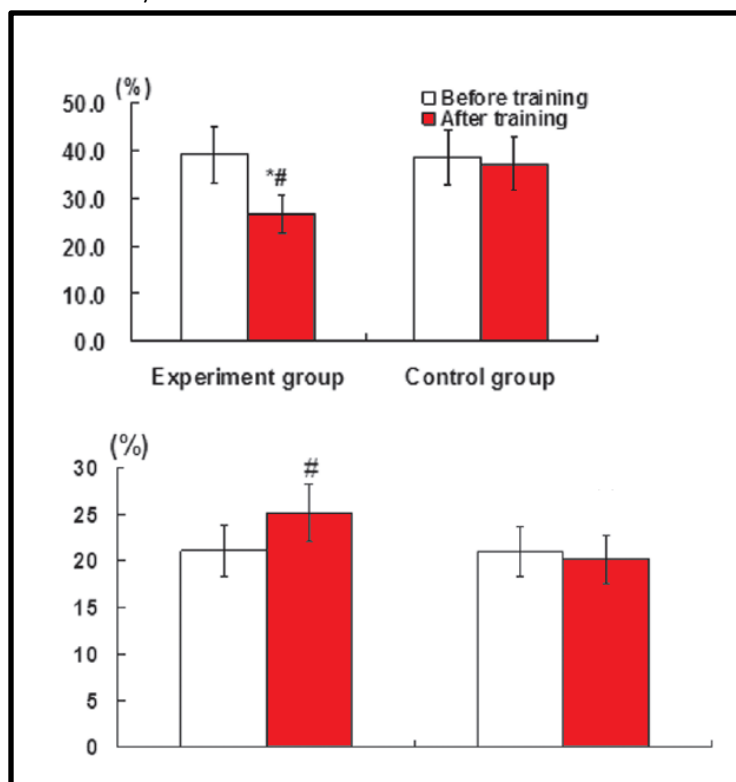


Figure 3. (Top) Percent change in immune cells involved in adaptive immunity before and after training. (Bottom) Change in immune cells involved in innate immunity and control group before and after training. <sup>\*</sup>Significant difference ( $p < 0.05$ ) between pre- and post-training in the experimental group; <sup>#</sup> Significant difference ( $p < 0.05$ ) between the experimental group's post-training and control group's post-training percent change in cell counts.

### • Preservation of Gut Integrity:<sup>\*</sup>

In a randomized, double-blind, placebo-controlled experimental study with 7 healthy volunteers receiving one dose of 0.9g/kg body weight glutamine or placebo 2 hours before intense exercise, it was demonstrated that glutamine was able to curb the increase of intestinal permeability triggered by intense exercise, as measured by the lactulose/rhamnose ratio and plasma endotoxin levels.

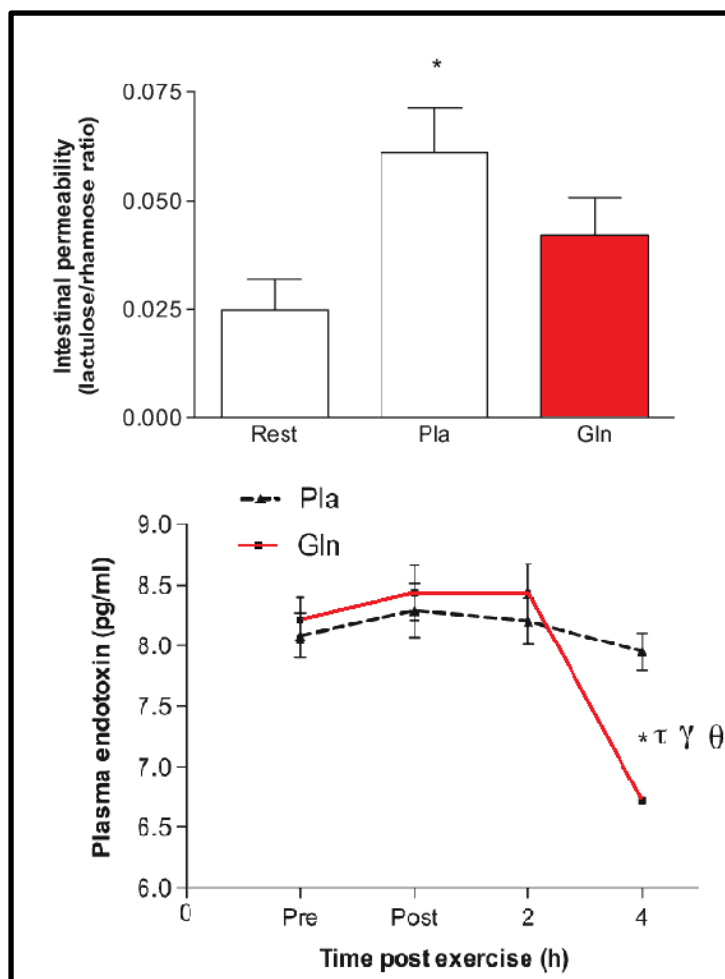


Figure 4. (Top) The effect of acute glutamine (Gln) supplementation on exercise-induced intestinal permeability. Permeability was measured as the ratio of urine levels of lactulose to rhamnose. <sup>\*</sup> $p < 0.05$ , significantly different from the rest. (Bottom): The effect of acute glutamine supplementation on plasma endotoxin levels, which is a marker of intestinal permeability. <sup>\*</sup> $p < 0.05$ , significantly different from the same time point in the placebo trial. <sup>τ</sup> $p < 0.05$ , significantly different from the pre-exercise level in the same trial. <sup>γ</sup> $p < 0.05$ , significantly different from the post-exercise time point in the same trial. <sup>θ</sup> $p < 0.05$ , significantly different from the 2-hour time point in the same trial.

### SAFETY INFORMATION

**Tolerability:** The average daily intake of glutamine from dietary protein is 3–6 g/d. Short-term glutamine supplementation is generally well tolerated at daily doses up to 50 to 60 g per day.

**Contraindications:** There are no known contraindications for the oral intake of glutamine, which is an amino acid present in food.

**Caution:** Individuals with liver conditions, bipolar and seizure disorders, and MSG hypersensitivity should take glutamine supplementation under the supervision of a healthcare practitioner as increased glutamine intake may temporarily increase serum glutamate and ammonia levels.

<sup>\*</sup>These statements have not been evaluated by the Food and Drug Administration. This product is not intended to diagnose, treat, cure, or prevent any disease.

**INTERACTIONS**

**Drug Interactions:** Glutamine may theoretically exhibit antagonistic effects with lactulose and anticonvulsant drugs such as Neurontin, Dilantin, and Tegretol.

**Supplement Interactions:** None known.

**Interaction with Lab Tests:** The metabolites of glutamine, ammonia and glutamate may affect the outcome of diagnostic tests for serum ammonia levels and serum glutamate levels respectively, when taken in high doses.

**STORAGE**

Store in a cool dry place in tightly sealed container.