Research Article

Available Online at: www.ijpir.com

International Journal of Pharmacy and Industrial Research

ISSN Print 2231 – 3648
Online 2231 – 3656

Glucogold: supports the maintenance of lean muscle mass and the immune system

Govind Shukla, Neha S.Giri, C.J. Sampath Kumar

[1]Lactonova Nutripharm (P) Ltd, Makers of Glucogold Powder 81/3, IDA Mallapur, Hyderabad, Telangana, India-500 076.

ABSTRACT

Glutamine is the most abundant free amino acid in human muscle and plasma. Inadult humans, following an overnight fast, the normal plasma glutamine concentration is 550–750 mmol/L and the skeletal muscle glutamine concentration is 20 mmol/kg wet weight. Skeletal muscle is the major tissue involved in glutamine synthesis and is known to release glutamine into the circulation at 50 mmol/h in the fed state. Its alleged effects can be classified as anabolic and immunostimulatory. Glutamine is utilized at high rates by leukocytes (particularly lymphocytes) to provide energy and optimal conditions for nucleotide biosynthesis and hence, cell proliferation Athletes can have high intakes of L-glutamine because of their high energy and protein intakes and also because they consume protein supplements, protein hydrolysates, and free amino acids. Prolonged exercise and periods of heavy training are associated with a decrease in the plasma glutamine concentration and this has been suggested to be a potential cause of the exercise-induced immune impairment and increased susceptibility to infection in athletes.

Keywords: Lean muscle mass, Immune system, Intense training.

INTRODUCTION

L-Glutamine is a naturally occurring nonessential neutral amino acid. It is important as a constituent of proteins and as a means of nitrogen transport between tissues [1]. It is also important in acidbase regulation, gluconeogenesis, and as a precursor of nucleotide bases and the antioxidant glutathione. Glutamine is the most abundant free amino acid in human muscle and plasma. In adult humans, following an overnight fast, the normal plasma glutamine concentration is 550–750 mmol/L and the skeletal muscle glutamine concentration is; 20 mmol/kg wet weight [2]. Skeletal muscle is the major tissue involved in glutamine synthesis and is known to release glutamine into the circulation at; 50 mmol/h in the fed state. Its alleged effects can be classified as anabolic and immunostimulatory. Glutamine is utilized at high rates by leukocytes (particularly lymphocytes) to provide energy and optimal conditions for nucleotide biosynthesis and hence, cell proliferation [3]. Indeed, glutamine is

Author for Correspondence:
Govind Shukla
Lactonova Nutripharm (P) Ltd, Makers of Glucogold Powder 81/3, IDA Mallapur, Hyderabad, Telangana, India-500 076.

considered important, if not essential, to lymphocytes and other rapidly dividing cells, including the gut mucosa and bone marrow stem cells. Unlike skeletal muscle, leukocytes do not possess the enzyme glutamine synthetase, which catalyses the synthesis of glutamine from ammonia (NH3) and glutamate, and therefore leukocytes are unable to synthesize glutamine [3].. Consequently, leukocytes are largely dependent on skeletal muscle glutamine synthesis and release into the blood to satisfy their metabolic requirements.

Prolonged exercise is associated with a decrease in the intramuscular and plasma concentrations of glutamine and it has been hypothesized that this decrease in glutamine availability could impair immune function [4]. Periods of very heavy training are associated with a chronic reduction in plasma concentrations of glutamine and it has been suggested that this may be partly responsible for the immune depression apparent in many endurance athletes [4]. The intramuscular concentration of glutamine is known to be related to the rate of net protein synthesis [5] and there is also some evidence for a role for glutamine in promoting glycogen synthesis [6]. However, the mechanisms underlying these alleged anabolic effects of glutamine remain to be elucidated.

L-Glutamine and immune function

In humans, glutamine has been shown to influence in vitro lymphocyte proliferation in response to mitogens in a concentration- dependent manner with optimal proliferation at a glutamine concentration of; 600 mmol/L [7]. It is the requirement of glutamine for both energy provision and nucleotide synthesis in immune cells that has led to the hypothesis that a decrease in the plasma glutamine level below; 600 mmol/L will have deleterious effects on immune function. It has been speculated that failure of the muscle to provide sufficient glutamine could result in a depressed rate of lymphocyte proliferation in response to antigens and so might impair immune defense to viral infection [8]. Intense physical exercise might decrease the rate of glutamine release from skeletal muscle and/or increase the rate of glutamine uptake by other organs or tissues that utilize glutamine (e.g. liver, kidneys), thereby limiting glutamine availability for cells of the immune system [8].

Acute exercise effects on plasma glutamine

The effects of acute exercise on plasma glutamine concentration appear to be largely dependent on the duration and intensity of exercise [9]. Studies have shown an increase [10, 11]. or no change [12] in plasma glutamine levels following short-term (,1 h) high intensity exercise in humans. For example, Babij et al. [10] observed an increase in glutamine concentration from 575 mmol/L at rest to 734 mmol/L during exercise at 100% of maximum oxygen uptake (VO2 max)3. It has been speculated [11] that the increase in plasma glutamine levels during short term high intensity exercise may be due to glutamate acting as a sink for NH3 in the formation of glutamine from glutamate during enhanced intramuscular NH3 production in high intensity exercise (the NH3 is predominantly derived from the deamination of adenosine monophosphate).

In contrast to the data for high intensity exercise, there is a consistent body of evidence showing that the plasma glutamine levels fall substantially after very prolonged exercise. Plasma glutamine concentration decreased from 557 mmol/L at rest to 470 mmol/L immediately after 3.75 h of cycling at 50%VO2 max [5]. The plasma glutamine concentration reached a minimum of 391 mmol/L after 2 h of recovery and remained depressed at 482 mmol/L after 4.5 h of recovery. Large declines in plasma glutamine level following amarathon race from592 mmol/L (prerace) to 495 mmol/L immediately postrace were reported in 24 club standardathletes [4]. Continuous cycling at 55% VO2 max for 3 h in 18 healthy males resulted in a decrease in plasma glutamine concentration from 580 mmol/L pre exercise to 447 mmol/L after 1 h recovery. However, continuous cycling to exhaustion at 80%VO2max (mean endurance time was 38 min) in the same subjects did not alter the plasma glutamine concentration compared with pre exercise [12]. The decline in plasma glutamine concentrations after prolonged exercise is probably due to increased hepatic uptake of glutamine for gluconeogenesis and synthesis of acute phase proteins and/or to increased kidney glutamine uptake in an attempt to buffer acidosis [9]. Increased glutamine uptake by activated leukocytes may also contribute to the fall in plasma glutamine levels after prolonged exercise, although limited

evidence is available to support this suggestion [13].

Prolonged exercise is known to cause an elevation in plasma cortisol concentration, which stimulates not only protein catabolism and glutamine release but also increases gluconeogenesis in the liver, gastrointestinal tract, and kidneys [14]. Increased hepatic, gastrointestinal, and renal uptake of glutamine could place a significant drain on plasma glutamine availability after prolonged exercise. Similar changes in plasma stress hormones occur after starvation, surgical trauma, sepsis, burns, and prolonged exercise, and all of these states of catabolic stress are characterized by lowered plasma glutamine concentrations, depressed cellular immunity, and increased gluconeogenesis [8]. In conditions of metabolic acidosis, the renal uptake of glutamine increases to provide for ammoniagenesis. Dietinduced metabolic acidosis with a high-protein (24% of energy): high-fat (72% of energy) diet for 4 d led to a 25% reduction in the concentrations of glutamine in both plasma and muscle (15). In this situation, it seems likely that release of glutamine from muscle may have increased, along with renal uptake, in an attempt to maintain acid-base balance. Walsh et al. [9] have suggested that a common mechanism may be responsible for depletion of plasma glutamine after prolonged exercise, starvation, and physical trauma, namely, increased hepatic and gastrointestinal uptake of glutamine for gluconeogenesis at a time when muscle release of glutamine remains constant or falls.

L-Glutamine supplementation, immune function and infection

A study with a rat model indicated that glutamine supplementation of 1000 mg/kg body mass (bm) by gavage increased the phagocytic capacity of neutrophils and the production of reactive oxygen species and abolished the decrease in nitric oxide production induced by exercise [18]. However, several glutamine feeding intervention studies in humans suggest that glutamine supplementation before and after exercise has no detectable effect on exercise-induced changes in immune cell functions. In a randomized, cross-over, placebo-controlled study, Rohde et al. [19] had subjects perform 3 successive bouts of cycle ergometer exercise at 75% VO2 max for 60, 45, and 30 min with 2 h rest between each bout. Subjects were fed glutamine (0.1 g/kg bm) 30 min before the end of each exercise bout and 30 min after each exercise bout. The arterial plasma glutamine concentration declined from 508 6 35 mmol/L (pre exercise) to 402 6 38 mmol/L at 2 h after the last exercise bout in the placebo trial and was maintained above pre exercise levels in the glutamine supplementation trial. Although glutamine feeding prevented the fall in the plasma glutamine concentration, it did not prevent the fall in lymphocyte proliferation 2 h after each bout or the fall in activity of lymphokine activated killer cells at 2 h after the final bout of exercise. Using similar glutamine treatments, other recent studies have also shown that glutamine supplementation (sufficient to prevent any fall in the plasma glutamine concentration) during and after 2 h of cycling did not prevent the decrease in the activity of natural killer cells (20) or in the concentration of immunoglobulin-A in saliva [21]. In another study, subjects ingested 3 g of glutamine every 15 min during the final 30 min of a 2-h exercise bout and every 15 min during a subsequent 2-h recovery period (total intake of 30 g) with no effect on the exercise-induced transient decrease in bacteria-stimulated neutrophil degranulation [22].

Castell et al. [17] have provided the only evidence to date for a prophylactic effect of oral glutamine supplementation on the occurrence of URTI in athletes. In a randomized, double blinded, placebo-controlled study, ultra-marathon and marathon runners participating in races were given either a placebo or a glutamine beverage (5 g glutamine in 330 mL water), which was ingested immediately after and 2 h after the race. The runners were given questionnaires to self-report the occurrence of symptoms of URTI for 7 d after the race. In those receiving the glutamine drink (n ¼ 72), 81% experienced no URTI episodes in the week following the race, whereas in those receiving the placebo (maltodextrin) drink (n ¼ 79), only 49% experienced no URTI episodes in the week following the race. Although the reporting of URTI symptoms increased following the race in both groups, it was concluded that the provision of the glutamine supplement in the 2 h following the race decreased the incidence of infection in the week after the event. However, it is unlikely that the

glutamine dose given was actually sufficient to prevent the post exercise decline in the plasma glutamine concentrations. Indeed, in another study by the same group, plasma glutamine concentration decreased similarly in placebo and glutamine-supplemented groups when glutamine was supplemented (5 g glutamine in 330 mL water) immediately after and 2 h after a marathon [23]. Another glutamine feeding study showed that an oral dose of 0.1 g/kg bm (;7 g) increased plasma glutamine concentration by ;50% within 30 min and glutamine concentration returned to baseline within 90–120 min [24]. Thus, doses in excess of 5 g need to be ingested at frequent intervals (e.g. every 30–60 min) to sustain a moderate elevation of the plasma glutamine concentration over several hours.

GLUCOGOLD™

- L-glutamine in **GLUCOGOLD** serves as an energy source to help build and maintain muscle mass and may help inhibit storage of fat.
- **Helps to prevent muscle damage after intense training, increases endurance, supports immune system, fights weight gain, fatigue and supports recovery and growth.**
- No added artificial sweeteners (aspartame, acesulfame, sucralose... etc.).
- L-glutamine in **GLUCOGOLD** is anti-catabolic, which helps to prevent the breakdown of muscle tissue.

Composition of GLUCOGOLD Powder
One Level Scoop (g) Contains: L-Glutamine 5 g

Product Description

L-Glutamine is the most abundant amino acid found in the blood stream. It can be used in the post –workout recovery process to help manage muscle damage that can occur from intense training. L-Glutamine is considered to be a conditionally essential amino acid, meaning in normal and healthy environments. Body produces enough L-glutamine to stay balanced. However, when body is stressed, training at a high level, or undernourished, it might not be able to keep production of L-glutamine at the level it needs. During these times additional L-Glutamine needed to help maintain normal levels.

L-Glutamine serves as an energy source to help build and maintain muscle mass and helps inhibit storage of fat. By maintaining healthy levels of L-Glutamine in body, cells are able to maintain optimal hydration, which protects, muscles and immune system from injury during and after exercise

Contra-indications

Product is contra-indicated in persons with Known hypersensitivity to any component of the product hypersensitivity to any component of the product.

Suggested Use

Mix 1 level scoop of powder with at least 8 ounces of water, juice, or preferred beverage daily or as recommended by your health-care or performance professional.

Warnings Allergywarning

This product is contraindicated in an individual with a history of hypersensitivity to any of its ingredients.

PREGNANCY

If pregnant, consult your health-care practitioner before using this product.

INTERACTIONS

There are no known adverse interactions or contraindications at publication date

Storage

Store in a cool, dry and dark place.

FAQS

Is L-glutamine a steroid?

No. L-glutamine is an amino acid found in small amounts in many of the foods we eat, and it's the most abundant amino acid in our bloodstream and muscle tissues. L-glutamine supplements are designed to support your body's natural L-glutamine supply, which can be compromised when you're sick, injured, or stressed during intense exercise.

When is the best time to consume L-glutamine?

L-glutamine is great for post-workout consumption, however, supplementation two to three times a day can also help maintain the healthy blood levels needed to build muscle and help maintain normal immune function.

Do people other than athletes use L-glutamine?

L-glutamine is being highly researched in areas involving wound healing following surgery, bowel health, and for the nutritional support of cancer patients because of its capability to build protein, provide necessary fuel to repair cells, and support normal immune function.

FUNDING

This work was supported in part by grants from lactonova nutritional research foundation Hyderabad and funds from pugos products Pvt Ltd Bangalore.

Conflicts of interest statement

The authors declare that there is no conflict of interest.

Summary & Conclusion

L-Glutamine is considered to be a conditionally essential amino acid, in normal and healthy environments body produces enough L-glutamine to stay balanced. However, when body is stressed, training at a high level, or undernourished, it might not be able to keep production of L-glutamine at the level it needs. During these times additional L-Glutamine might be needed to help maintain normal levels.

L-Glutamine serves as an energy source to help build and maintain muscle mass and may help inhibit storage of fat. By maintaining healthy levels of L-Glutamine in body, cells are able to maintain optimal hydration, which protects, muscles and immune system from injury during and after exercise.

REFERENCES

[1]. Watford M. Glutamine metabolism and function in relation to proline synthesis and the safety of glutamine and proline supplementation. J Nutr. 7, 2008, 138 2003.
[2]. Jonnalagadda SS. Glutamine. In: Driskell JA, editor. Sports nutrition: fats and proteins. Boca Raton (FL): CRC Press; 2007, 261–77.
[3]. Ardawi MS, Newsholme EA. Glutamine metabolism in lymphocytes of the rat. Biochem J. 42, 1983, 212-835.
[4]. Parry-Billings M, Budgett R, Koutedakis Y, Blomstrand E, Brooks S, Williams C, Calder PC, Pilling S, Baigrie R, et al. Plasma amino acid concentrations in the overtraining syndrome: possible effects on the immune system. Med Sci Sports Exerc. 8, 1992, 24-1353.
[5]. Rennie MJ, Edwards RH, Krywawych S, Davies CT, Halliday D, Waterlow JC, Millward DJ. Effect of exercise on protein turnover in man. Clin Sci. 39, 1981, 61-627
[6]. Bowtell JL, Gelly K, Jackman ML, Patel A, Simeoni M, Rennie MJ. Effect of oral glutamine on whole body carbohydrate storage during recovery from exhaustive exercise. J Appl Physiol. 7, 1999, 86-1770.
[7]. Parry-Billings M, Evans J, Calder PC, Newsholme EA. Does glutamine contribute to immunosuppression after major burns? Lancet. 5, 1990, 336-523.
[8]. Parry-Billings M, Blomstrand E, McAndrew N, Newsholme EA. A communicational link between skeletal muscle, brain, and cells of the immune system. Int J Sports Med. 11, 1990, 2–8.
[9]. Walsh NP, Blannin AK, Robson PJ, Gleeson M. Glutamine, exercise and immune function. Links and possible mechanisms. Sports Med. 26, 1998, 177–91.

[10]. Babij P, Matthews SM, Rennie MJ. Changes in blood ammonia, lactate and amino acids in relation to workload during bicycle ergometer exercise in man. Eur J Appl Physiol Occup Physiol. 50, 1983, 405–11.
[11]. Sewell DA, Gleeson M, Blannin AK. Hyperammonaemia in relation to high intensity exercise duration in man. Eur J Appl Physiol Occup Physiol. 39, 1994, 350–4.
[12]. Robson PJ, Blannin AK, Walsh NP, Castell LM, Gleeson M. Effects of exercise intensity, duration and recovery on in vitro neutrophil function in male athletes. Int J Sports Med. 20, 1999, 128–35.
[13]. MacKinnon LT, Hooper SL. Plasma glutamine and upper respiratory tract infection during intensified training in swimmers. Med Sci Sports Exerc. 28, 1996, 285–90.
[14]. Stumvoll M, Perriello G, Meyer C, Gerich J. Role of glutamine in human carbohydrate metabolism in kidney and other tissues. Kidney Int. 55, 1999, 778–92.
[15]. Greenhaff PL, Gleeson M, Maughan RJ. The effects of diet on muscle pH and metabolism during high intensity exercise. Eur J Appl Physiol Occup Physiol. 57, 1988, 531–9.
[16]. Kingsbury KJ, Kay L, Hjelm M. Contrasting plasma amino acid patterns in elite athletes: association with fatigue and infection. Br J Sports Med. 32, 1998, 25–33.
[17]. Castell LM, Poortmans JR, Newsholme EA. Does glutamine have a role in reducing infections in athletes? Eur J Appl Physiol Occup Physiol. 73, 1996, 488–90.
[18]. Lagranha CJ, de Lima TM, Senna SM, Doi SQ, Curi R, Pithon-Curi TC. The effect of glutamine supplementation on the functions of neutrophils from exercised rats. Cell Biochem Funct. 23, 2005, 101–7.
[19]. Rohde T, MacLean DA, Pedersen BK. Effect of glutamine supplementation on changes in the immune system induced by repeated exercise. Med Sci Sports Exerc. 30, 1998, 856–62.
[20]. Krzywkowski K, Petersen EW, Ostrowski K, Kristensen JH, Boza J, Pedersen BK. Effect of glutamine supplementation on exercise-induced changes in lymphocyte function. Am J Physiol Cell Physiol. 281, 2001, 1259–65.
[21]. Krzywkowski K, Petersen EW, Ostrowski K, Link-Amster H, Boza J, Halkjaer-Kristensen J, Pedersen BK. Effect of glutamine and protein supplementation on exercise-induced decreases in salivary IgA. J Appl Physiol. 91, 2001, 832–8.
[22]. Walsh NP, Blannin AK, Bishop NC, Robson PJ, Gleeson M. Effect of oral glutamine supplementation on human neutrophil lipopolysaccharidestimulated degranulation following prolonged exercise. Int J Sport Nutr. 10, 2000, 39–50.
[23]. Castell LM, Newsholme EA. The effects of oral glutamine supplementation on athletes after prolonged, exhaustive exercise. Nutrition. 13, 1997, 738–42.
[24]. Ziegler TR, Benfell K, Smith RJ, Young LS, Brown E, Ferrari-BalivieraE, Lowe DK, Wilmore DW. Safety and metabolic effects of L-glutamine administration in humans. JPEN J Parenter Enteral Nutr. 14, 1990, 137S–46S.
[25]. Gleeson M, Editor. Immune function in sport and exercise. Edinburgh: Elsevier 2005.