J. Appl. Environ. Biol. Sci., 1(8)276-280, 2011

ISSN 2090 – 424X
Journal of Applied Environmental and Biological Sciences
www.textroad.com

Immune Function and Plasma Glutamine in Response to Oral Glutamine Ingestion in Adult Trained Male

Bananaeifar A[1], Ghasemalipour H[1], Eizadi M[1], Kazemzade y[2]

[1]Department of Physical Education and Sport Science, South Tehran Branch, Islamic Azad University, Iran
[2]Department of Physical Education and Sport Science, Islamshahr Branch, Islamic Azad University, Iran

ABSTRACT

The effect of oral glutamine ingestion on the changes of plasma glutamine Levels and on some immune factors in a male athlete group was studied in this research. The research subjects were 20 Volunteer wrestlers at the age of 19 to 20 randomly divided in two control and test groups participating in a 16-session exercise Program.
The test group used glutamine supplement and the control group consumed placebo. Before the beginning of the program, the blood samples of the subjects were collected. In the end of the first session and before and after the last session, the blood samples of the subjects were collected again. The subjects participate in the exercise every day lasting for 90 minutes.
The end of the exercise they used placebo or the supplement. After measuring the blood factors, results were analyzed statistically with ate level of %5.
Findings showed that the levels of plasma glutamine in the end of a session for the beginning and last days of exercise period decreased meaningly in the control group. But in the second group, this level was kept near to the rest level. Changes of immune factors in the two groups ware similar. So it can be claimed that the use of nutritious glutamine cannot have amyl elect to protect immune factors.
Rest level of glutamine in the end of the Period decreased in the control group and increased in the test group ($p<\%5$). The results of this study did not reveal any relation between that decrease and changes of immune factors.
Keywords: Glutamine supplementation, Immune system, Exercise training.

INTRODUCTION

Physical exercise causes the motion of neutrophils and lymphocytes into blood circulation [5,10]. Following an intensified exercise lasting more than one hour, the concentration of lymphocytes, neutral killer cells (Nkcell) and the reaction of lymphocyte proliferation decreases [8,9]. It seems that low _ intense bodily activities have useful effects on immune system [1,13]. LOW _ intensity exercise leads to the increase of NKcells and the number of lymphocytes in blood circulation, indicating the improved performance of immune system [20,29]. In contrast, evidence has shown that intense exercise alleviates the performance of immune system [13, 30]. The mechanisms involved in this effect are hormone _ nerve factors such as ephynephrine, neuraphynephrine, growth hormone, corthisole, beta-endorphin [21].

Physiological factors, like body temperature increase during exercise. Any change in metabolic factors during exercise such as the decrease concentration of plasma glutamine can play a role in this process [22].

Glutamine, the richest acid amino in body, is used in the cells like lymphocytes and neutrophils which are undergoing rapid division. Glutamine, however, are considered as unnecessary amino acid but in wider metabolic pressures, body needs it more. So it is regarded as a conditioned amino acid [1, 3].

For many years it was believed that immune system cells used glucose as main fuel [25]. But in the early 80's, it was found that these cells use glutamine in the same amount and in the same direction as they use glucose [1,2]. It has been shown that these cells, even inactive ones, Use a lot of glutamine [4]. Skelton muscles have a high capacity to synthesize glutamine and a great role in keeping the appropriate concentration of plasma glutamine. Therefore, it is recognized as the biggest resource of glutamine in body [23,25].its activity can influence immune system directly.

Muscles and other organs (lymphoid system) need for glutamine can under intensified exercise result in the shortage of glutamine in body, so that affecting their performances (glutamine hypothesis). In laboratory sphere (In vitro) the response of lymphocytes depends upon glutamines presence [27.32]. So, those factors directly or indirectly influencing the plasma glutamine level can theoretically affect the performance of lymphocytes, neutrophiles and monocytes as well [25].

After long term and intensified exercises and under bodily pressures, the concentration of plasma glutamine decreases [4, 14, 17, 22, 27]. It seems that this decrease has an important role in the weakened immune system resulted from physical exercise [23]. When plasma glutamine decreases, it can be useful for immune system cells to consume supplement glutamine.(In one research) Some investigations concerned to the effect of glutamine as one part of daily diet on immune system (shown , the plummet of glutamine and the rate of proliferation were kept, but in the control group these indications were not seem [9].for the athletes using glutamine after an intensified exercise, their respiratory

***Correspondence Author:** Bananaeifar Abdolali, Department of physical education and sport science, South Tehran Branch, Islamic Azad University, Iran. E-mail: abbt50@yahoo.com

infection got controlled for 7 day. eighty one percent of them did not have such infection, but 49% of the control group reported that infection. Generally it is possible that the decrees of plasma glutamine after intensified exercises influence immune system cells performance. In the current study, the aim is to study the influence of nutritious glutamine consumption on the plasma glutamine exercise-induced changes and immune system variation stemming from such exercise.

2. METHODOLOGY

Subject

With regard to this fact that our statistical society consisted of some members of wrestling club which had at least a four year participation in sport competitions, bodily readiness tests were carried out to harmonize the wrestlers bodily readiness level. To do so, 20 wrestlers were randomly divided in two qroups, the control group and the test one (N=10).

Average age of the control group was 21/5 +1/12 years old and that of the test group was 21/2 + 1/22 yeans old.

Experimental method

The subjects participated in a 16 session training program lasting 90 minutes for each session.

The training program included stationary movements and specialized exercises of wrestling carried out in one _ day intervals.the intensity Activity was adjusted in the rang of 65- 80 of the stored heart palpitation.it gradually increasing, that intensity was controlled by telemetry among four persons randomly chosen in each session. Before the beginning of the first session, 8cc blood was taken from the subjects hand veins. Those blood samples were kept in some tubes containing heparin and EDTA (Editate. Etilic. Acid) 30 minutes after that blood taking, the subjects exercised for 90 minutes and then used glutamine solutions or placebo after 75 minutes from the beggining of the exercise, the test group used 50 mg glutamine for one kg of body weights in 200 cc water _ Lemonade solution . The control group used the same amount water _ Lemonade solution at the sometime.

At the end of the first session, blood samples were taken again. After 15 sessions, accompanied with using that solution and placebo, blood samples were taken before and after the activity like the first session. Blood samples taken were sent to a laboratory. Blood samples were taken immediately after the exercise while the subjects seated.

The Measurement of blood factors.

The samples of EDTA were tested in the laboratory. The method of cell numeration, immune factors was measured. The plasma of the tubes containing heparin was separated by a centrifuge with 10000r.p.m and freeze at-70 so that the level of their glutamine was determined by the method of HPLC (high liquid chromatography).

Statistical method

To analyze the data, the method of one-way variance analysis (ANOVA) was used. Different times of blood taking during the period were used as means of the under study . To determine the difference between those (means), the method of TOKI tests was applied. The statically meaningful area of this analysis was p<0/05

Results and findings of the research

After the first session , the levels of plasma glutamine of the control group decreased as compared with the level before the session ($p < 0.001$) while these levels for the test group were near to the rest levels ($p < 0.05$) . in the second stage of blood taking , or in the 16 th session , the levels of plasma glutamine of the control group decreased meaningfully after the activity as compared with the levels before the exercise .

For the test group, the second stage of blood taking revealed those levels slightly higher that the plasma glutamine levels of the control group decreased in the last session (figure .1)

The amount of leukocyte of the both groups increased after the one session. At the end of the period , these levels for the both groups increased . The comparison of the first session and last sessions' rest levels indicate that the concentration of leucocytes in the last session decreased marginally in the both groups. The changes of neutrophyls in the both groups were similar to those of leucocytes concentration ($p > 0.05$) (figure. 2). The lymphocytes levels of the groups decreased meaningfully in the end of the first and second sessions (p<0/001). Comparison between the rest levels of the first sessions and the exert levels of the last session indicated a marginal decrease of lymphocytes in the both groups.

DISCUSSION AND CONCLUSIONS

The use of glutamine in the end of every exercise session prevents the level of plasma glutamine from decreasing, without affecting the exercise– induced changes of lymphocytes, neutrophiles and leucocytes concentrations. Previous literature reflects the same results [14, 17, 31]. It seems that the consumption of glutamine in a test group supplies the needs of various tissues during and after exercises, preventing the decrease of plasma glutamine level. The use of glutamine supplementation during sessions brought a 22% increase of rest levels of the test group at the end of the period. such increase was not seen in the control group , but the decrease of plasma glutamine levels caused by intensified exercise and by lack of glutamine supplementation was reported [5 ,18, 27, 30]. The levels of plasma glutamine of the control group decreased after the first session. In this group, the rest levels of plasma group decreased 13 percent on average (p<0/001).

These results indicate that the levels of plasma glutamine are influenced by exercise and exercise possibly increases the need body for it. Since there were similar changes in the immune factors such as increase in leucocytes, and neutrophiles, and decrease in lymphocytes after the exercise in the beginning and at end of the training program for the both groups, it does not seem that it is an indication for a relation between the decrease of plasma glutamine levels and immune factors. Based on the role of glutamine in body and its decrease in the control group.

It can be sure that body needs more glutamine during exercise and that 13 percent decrease of rest glutamine levels in the control group suggests the shortage of adequate resource for glutamine in body.

Some justifying mechanisms can be proposed for that decrease WBC are as follows:

- Decrease of stored glutamine in muscles.
- Decrease of received proteins.
- Increase of glutamine consumption by some tissues like kidney (to keep acid- base balanced) and liver (as a preparing step for the synthese of anti oxidant glutatione.

As conclusion, despite some reports indicating the decrease of respiratory infection in the runners using glutamine supplementation and the increased concentration and the increased lymphocytes proliferation response in presence of glutamine [3, 29], it is expected that the usage of glutamine supplement can affect the changes of immune factors during an exercise program. However, some investigations do not support this finding [14, 31].

The current study shows that the use of glutamine in the end of each exercise session prevents the levels of plasma glutamine from any decrease, without influencing immune factors. So it can be stated that the findings of this research do not support the glutamine theory. To elaborate this subject, more researches on the effects of different dozes of glutamine, the timing of its use and its effects on the parameters of immune system are needed.

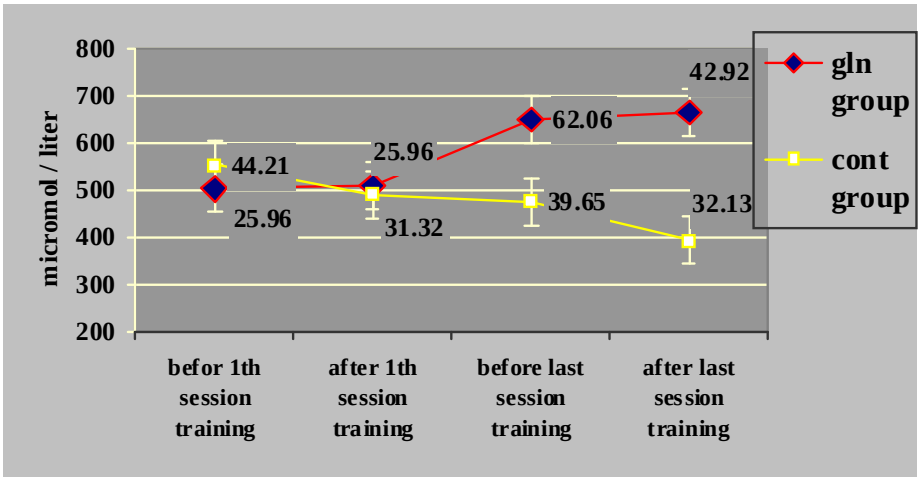

Fig. 1: plasma gln concentration before and after exercise in 1th , 16 th session of training.

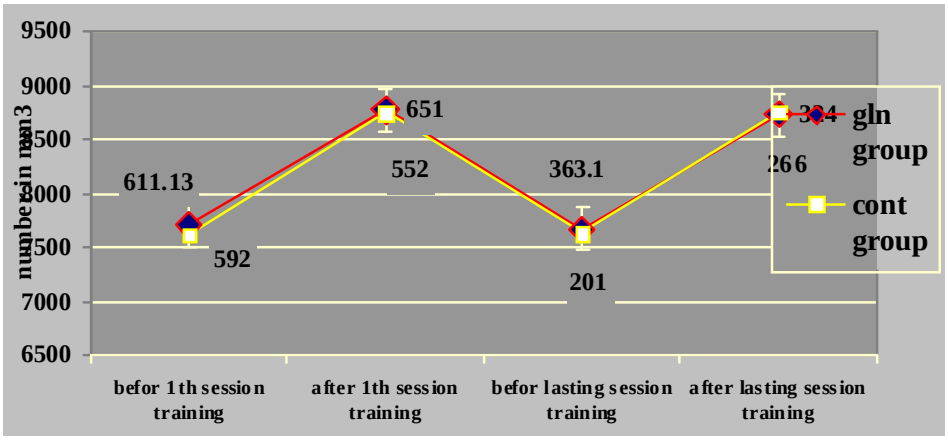

Figure 2 . concentration of plasma leucocytes in first and end of training program

REFERENCES

1. Akerström TC, Pedersen BK.Strategies to enhance immune function for marathon runners : what can be done? Sports Med. 2007;37(4-5):416-9.
2. Ardawi, MSM.Newsholme, EA. Maximum activites of some enzymes of glycolysis, the tricarboxylic acid cycle and ketone-body and glutamine utilization pathways in lymphocytes of the rat. Biochem J 1982; 208: 743-8
3. Castell, LM. Poortmans, JR. and Newsholme, EA. Does glutamine have a role in reducing infections in athletes? Eur J Appl Physiol Occup Physiol 1997;73: 488-490.
4. Castell, LM. Poortmans, JR. Leclercq, R. Brasseur, M. Duchateau, J. and Newsholme, EA. Some aspects of the acute phase response after a marathon race, and the effects of glutamine supplementation. Eur J Appl Physiol 1997;75: 47-53.
5. Castell L, Vance C, Abbott R, Marquez J, Eggleton P. Granule localization of glutaminase in human neutrophils and the consequence of glutamine utilization for neutrophil activity. J Biol Chem. 2004 Apr 2;279(14):13305-10. Epub 2004 Jan 13.
6. Dohm, GL.Beecher, GR. Warren, RQ et al. Influence of exercise on free amino acid concentrations in rat tissues .J Appl physiol 1981 ; 50 : 41-4
7. Essen, P. Wernerman, J. Sonnenfeld, T. Thunell, S. and Vinnars, E. Free amino acids in plasma and muscle during 24 hours post-operativelya descriptive study. Clin Physiol 1992;12: 163-177.
8. Fahr, MJ. Kornbluth, J. Blossom, S. Schaeffer, R. and Klimberg, VS. Harry M. Vars Research Award. Glutamine enhances immunoregulation of tumor growth. JPEN J Parenter Enteral Nutr 1994;18: 471-476.
9. Gleeson M.Dosing and efficacy of glutamine supplementation in human exercise and sport training.J Nutr. 2008 Oct;138(10):2045S-2049S. Review
10. Haussinger, D.Glutamine metabolism in the liver : overview and current concept .Metabolism 1989;38 suppl. 1: 14-7
11. . Hoffman-Goetz, L. and Pedersen, BK. Exercise and the immune system: a model of the stress response? Immunol Today 1994;15: 382-387.
12. HOFFMAN-GOETZ, L Exercise, immunity, and colon cancer. In: Exercise and Immune Function, edited by L. Hoffman-Goetz, and J. Husted. Boca Raton, FL: CRC, 1996, p. 179-198.
13. Keast, D. Morton, AR. Long-term exercise and immune functions. In: Watson RR, Eisinger M, eds. Exercise and disease 1992:89–120.
14. Keast, D. ARSTEIN, D. HARPER, W. FRY, RW. AND MORTON, AR. Depression of plasma glutamine concentration after exercise stress and its possible influence on the immune system. Med J Aust 1995;162: 15-18.
15. Krzywkowski, K. Petersen, EK. Ostrowski, K. Kristensen, JH. Boza, J. Pedersen, BK. Effect of glutamine supplementation on exercise-induced changes in lymphocyte function. Vol. 281, Issue 4 October 2001, C1259-C1265,
16. Lehmann, M. Huonker, M. Dimeo, F. Heinz, N. Gastmann, U. Treis, N. Steinacker, JM. Keul, J. Kajewski, R. and Haussinger, D. Serum amino acid concentrations in nine athletes before and after the 1993 Colmar ultra triathlon. Int J Sports Med 1995;16: 155-159,
17. Li Y, Xu B, Liu F, Tan L, Li J. The effect of glutamine-supplemented total parenteral nutrition on nutrition and intestinal absorptive function in a rat model. Pediatr Surg Int. 2006;22:508–513. doi: 10.1007/s00383-006-1693-9.
18. Mackinon, LT,HOOPer, SL.Plasma glutamine and upper respiratory tract infection during intensified training in swimmers.Med. Sci.Sports Exercise.1996;28 ,3:285-90
19. Maughon RJ, Gleeson M. Influence of a 36 h fast followed by refeeding with glucose, glycerol or placebo on metabolism and performance during prolonged exercise in man. Eur J Appl Physiol Occup Physiol. 1988;57(5):570-6.
20. Moreira A, Kekkonen RA, Delgado L, Fonseca J, Korpela R, Haahtela T.Nutritional modulation of exercise-induced immunodepression in athletes: a systematic review and meta-analysis. Eur J Clin Nutr. 2007 Apr;61(4):443-60. Epub 2006 Nov 29. Review.
21. Moriguchi, S. Miwa, H. Kishino, Y. Glutamine supplementation prevents the decrease of mitogen response after a treadmill exercise in rats. J Nutr Sci Vitaminol (Tokyo) 1995 Feb;41(1):115-25
22. Newsholme, EA,Crabtre, B. Ardawi, M. Glutamine metabolism in lymphocytes: its biochemical, physiological and clinical importance. Q J Exp Physiol. 1985 Oct;70(4):473-89. Review.

23. Newsholme, EA.and Parry bilings, M. . Properties of glutamine release from muscle and its importance for the immune system. J Parenteral Enteral Nutr 1990;14 Suppl: 63S-67S.

24. Newsholme, EA. Biochemical mechanisms to explain immunosuppression in well-trained and overtrained athletes. Int J Sports Med 1994;15 Suppl: S142-S147.

25. Ogle, CK. Ogle, JD. Mao, JX. Simon, J. Noel, JG. Li, BG. and Alexander, JW. Effect of glutamine on phagocytosis and bacterial killing by normal and pediatric burn patient neutrophils. JPEN J Parenter Enteral Nutr 1994;18: 128-133.

26. Parry-Billings, M. Evans, J. Calder, PC. and Newsholme, EA. Does glutamine contribute to immunosuppression after major burns? 1990; Lancet-525.

27. Parry-Billings, M,Budgett, R. Koutedakis, Y. Blomstrand, E. Brooks, S et al.Plasma amino acid concentrations in the overtraining syndrom: possible effects on the immune system .Med Sci Sports Exere 1992; 24 : 1353 -8

28. Pedersen, Bente Klarlund. and Laurie Hoffman-Goetz. Exercise and the Immune System: Regulation, Integration, and Adaptation. Physiol. Rev2000.; 80: 1055-1081.

29. Rohde, TH. Ullum, JP. Rasmussen, JH. Kristensen, E. Newsholme, and B. K. Pedersen. Effects of glutamine on the immune system: influence of muscular exercise and HIV infection. J. Appl. Physiol1995; 79: 146-150.

30. Rohde, T. MacLean, DA. and Klarlund, BK. Glutamine, lymphocyte proliferation and cytokine production. Scand J Immunol1996 ;44: 648-6 50,

31. ROHDE, T. ASP, S. MacLEAN, DA. AND PEDERSEN, BK.Effects of glutamine supplementation on chenges in immune systeme induced by repeated exercise.Med Sci Sports Exerc1998 ;30 :856 –62

32. Scheltinga, MR. Young, LS. Benfell, K. Bye, RL. Ziegler, TR. Santos, AA. Antin, JH. Schloerb, PR. and Wilmore, DW. Glutamine-enriched intravenous feedings attenuate extracellular fluid expansion after a standard stress. Ann Surg 1991;214: 385-393.

33. Yoshida, S. Yamasaki, K. Kaibara, A. Mizote, H. and Kakegawa, T. Glutamine (Gln) supplementation in septic rats. Nippon Geka Gakkai Zasshi 1993 ;94: 1078-1084.