AN OBSERVATIONAL STUDY OF PLASMA AMINO ACID PATTERNS IN PERFORMANCE ATHLETES

Interim Results: Starting Plasma Amino Acid Levels
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Note: This is an interim report on a prospective case series study being undertaken to explore the potential of customizing amino acid plasma profiles in high performance athletes and the subsequent impact on their athletic performance. The researchers have formulated this theory-based hypotheses in respect to the evolution of an on-going review of the important role played by amino acids and protein for elite athletes. These results will continue to be monitored in the future at pre-determined times using "pattern matching" post-intervention with orthomolecular compounds. End results will be published in a final report.

1) INTERIM ABSTRACT

Changes in plasma amino acid concentrations are induced by physical activity, especially those that are either intense or prolonged in nature. We selected fifteen hockey players during practice season and assessed their plasma amino acid profile by HPLC (high performance liquid chromatography) in search of a consistent pattern.

A high percentage of the players (93.3%) were found to be low in glutamate, arginine and lycine, followed by serine (86.6%) and methionine (80.0%). These findings (with the exception of lycine) corroborate well with those in the literature. Lycine has been reported to be high following exercise.

All the players (100%) had a high level of cystine and leucine. Our finding of a higher leucine level in post-exercise subjects is not in agreement with reports by other authors.

The next stage of this study will review the changes in individual amino acid profiles, post-intervention with targeted amino acid / orthomolecular compounds and the overall athletic performance.

2) INTRODUCTION

In exercise and sports activity there is a significant increase in the rate of amino acid catabolism resulting in a depletion of the plasma amino acid pool (1). Investigations using both human and laboratory models suggest that proteins and amino acids, under some conditions, may contribute significantly to total exercise calories (2). This is reflected as changes in the level of amino acids in the plasma. This interim report is intended to establish existing patterns of deviation from the optimal in the plasma amino acids levels in hockey players with the ultimate goal of exploring the potential of increasing performance through targeted orthomolecular intervention.

For a more detailed background to the hypothesis and relationship of this study to the ISM concept of Aminomics, the reader is urged to refer to "A Review of the Importance of Amino Acids in Sports Performance", October 2007, Chowdhury Zaman M.B.B.S., M.S., Dr. Ken Lin, B.Pharm., Ph.D. Biochemistry.

3) METHODS

Fifteen semi-pro/ professional hockey players were selected during practice season, and their plasma amino acid levels were measured. Data was collected on all 15 participants including qualitative and quantitative descriptive data analysis, patient age, sex, health status and clinical status. Customized HPLC (High Performance Liquid Chromatography) laboratory technology was employed for profiling the plasma amino acids.

Blood samples for amino acid analysis were obtained after an overnight fast from all participants. The samples were processed within 24 h after collection. Plasma was separated by centrifugation until the absence of platelets in the supernatant was confirmed. Plasma was separated from blood and deproteinized. Customized HPLC (High Performance Liquid Chromatography) laboratory technology was employed for profiling the plasma amino acids. Blood plasma concentrations of 28 amino acids were profiled. Individual profiles were referenced to standard amino acid norms (20).

The results were then compiled and compared. The data was reviewed to identify any consistent pattern in the amino acid levels.

4) INTERIM RESULTS

The male hockey players, tested in the midst of a practice season ranged in age from 16.5 to 24 years, with a mean of 19 years. A significant percentage of players were observed to have abnormal levels of glutamate, asparagine, serine, histidine, arginine, tyrosine, cystine, methionine, leucine and lycine.

A high percentage (93.3%) was found to be low in Glutamate, arginine and lycine, followed closely by serine (86.6%) and methionine (80.0%). All the players (100%) had high levels of cystine and leucine (Table 1).

Table 1

Amino acid	In optimal range (n=15)	Percentage of players in optimal range	Low levels (n=15)	**Percentage of players with a low level**	High levels (n=15)	**Percentage of players with a high level**
Glutamate	1	6.7	14	**93.3**	0	**0**
Asparagine	4	26.7	11	**73.3**	0	**0**
Serine	1	6.7	13	**86.7**	1	**6.7**
Histidine	2	13.3	10	**66.7**	3	**20.0**
Arginine	1	6.7	14	**93.3**	0	**0**
Tyrosine	4	26.7	11	**73.3**	0	**0**
Cystine	0	0	0	**0**	15	**100.0**
Methionine	3	20.0	12	**80.0**	0	**0**
Leucine	0	0	0	**0**	15	**100.0**
Lycine	1	6.7	14	**93.3**	0	**0**

5) INTERIM DISCUSSION

That most players had a low level of glutamate can quite easily be explained by the fact that during exercise the muscle uptake of glutamate from the blood is increased, leading to low plasma glutamate levels (1, 3-6). Glutamate plays a central role in energy provision during exercise because it participates in the tricarboxylic acid and the purine nucleotide cycles, and it has been reported that supplementation of glutamate or its precursor glutamine can influence muscle glutamate status (7).

We also noted a lower plasma concentration of asparagine, serine, histidine and methionine in a high proportion of individuals in our study, which is supported by other investigators in studies done with subjects involved in similar activity and exercise (5, 8, 9).

Asparagine slows down glycogen depletion in the muscles and liver, and supplementation with a combination of aspartate and asparagine has been reported to increase the contribution of oxidative metabolism in energy production and delay fatigue during exercise (10). The low asparagine levels in our subjects indicated a depletion of glycogen stores and persistence of fatigue following their physical activity.

It has been reported that arginine suppresses exercise-induced skeletal muscle proteolysis (11), and the consequent uptake of arginine by the muscles during exercise could account for the low level of arginine observed in the majority of our subjects.

Leucine, along with some other amino acids is used directly as oxidizable fuels during exercise and therefore the level of leucine in post-exercise plasma is reported to be lower than normal (8, 9, 12). It has been suggested that the lower leucine level following exercise is a reflection of leucine entry into muscle and its subsequent deamination (8).

In our study, however, all subjects had a higher than normal level of leucine. The time lapse between the end of the session of physical activity and measurement of the plasma amino acid could have had a bearing on our outcome.

Cystine was found to be elevated in all our cases. This corroborates well with the finding of other studies with trained athletes in whom plasma concentration of amino acids were measured following a prolonged competitive activity (13, 14).

One study reported an increase in plasma lycine levels following low-intensity regular exercise (15) which is in contrast to our findings where the lycine level was found to be lower than normal in 93.33% of the subjects.

Alanine has consistently been reported to be elevated following exercise (1, 4-6, 8, 16–18), and our search of the literature revealed only two reports of a decrease (15, 19). In our study, however, all of the fifteen hockey players were found to have normal levels of alanine in their plasma.

It is known that a number of amino acids can be converted to glutamate and then to alanine, which, along with lactate and pyruvate, are recognized as the major gluconeogenic precursors. It is through this mechanism that several amino acids play crucial roles in providing the carbon sources for maintaining blood glucose homeostasis during exercise and glycogen restitution during recovery (12), indicating the existence of a glucose-alanine cycle (8).

The time lapse between the termination of the physical activity and measurement of the plasma amino acid could have had a bearing on the fact that all our subjects had optimal levels of alanine in their plasma.

6) Preliminary Conclusions

Plasma amino acid measurements were made of fifteen hockey players during practice season. An attempt was made to detect a pattern in their plasma amino acid profiles. Low levels of glutamate, arginine and lycine were detected in most of the players (93.3%) followed by serine (86.7%) and methionine (80.0%). With the exception of lycine, our findings correlate well with those of other investigators.

All the players in our study had a high level of cystine and leucine in their plasma. Our finding of a high level of leucine is contrary to what has been observed in some studies. Moreover, reports on the level of alanine following exercise or athletic activity are conflicting. While most have observed an elevation in alanine levels, some investigators have also reported a decline. All the hockey players in our study had optimal levels of alanine when tested.

Therefore, these plasma results are likely satisfactory in terms of moving into Stage II of this study involving intervention using orthomolecular compounds for observation on the ergogenic potential.

7) FOOTNOTES

Conflict of interest: Chowdhury Zaman is the Medical Director and Dr. Ken Lin is the Lab Director for Immune System Management Inc., the corporate entity that has sponsored this research.

8) ACKNOWLEDGMENTS

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