

Study on the essential amino acid's supplements with absorption patterns in the improvement of the performance for sportspeople: GFS AMINO

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ABSTRACT

Sports-people's performance at their sport can vary due to the development of their athletic activity when competing. In addition to this, the scientific community have recently increased their interest for the study of essential amino acid's supplements (EA). The purpose of the present study is to examine the effect of the ingestion of an amino acid's supplement with absorption patterns and its relationship with the performance of 32 sportsmen in a maximum stress test of their VO₂max. For this study we used a double-blind design. Thirty-two experienced sportsmen, (aged 34 ± 6.5 and; height 178.5 ± 4.5 cm; weight 72.6 ± 8.6 kg), were evaluated during their performance. All of them followed an ingestion protocol of an amino acid supplement with absorption patterns (16.6gr) of GFS AMINOS dissolved in 140ml of water, 20 minutes before starting the test and a later execution consisting in an increasing-stress test, until they stopped voluntarily. At the end of the test we carried out a measuring of their Body Mass Index (BMI), a blood-lactate, a lower body strength test and a cognitive test. The results of this study showed significant differences ($P < 0.05$) in the performance over time and duration in the stress test, together with a lower loss of cognitive attention and a decreasing of the fat percentage. In sum, this essential amino acid supplement with absorption patterns GFS AMINOS can improve sports-people's performance and accelerate the use of body fat. **Key words:** ESSENTIAL AMINO ACIDS, GFS AMINOS, SPORTS PERFORMANCE, SUPPLEMENTATION, SPORTS-PEOPLE.

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INTRODUCTION

The high standards in sports-people has as a result a lack of nutrients that has been tried to be compensated for quite a long time. Since it has an effect on the athlete's motivation and his/her competitive performance. The first hypotheses were supported in some studies that were carried out with animals and human beings, the synthesis of brain serotonin (Davis and Bailey 1997) aiming to cover these sports-people's energetic needs who sometimes consume energy supplements. Apart from that, fatigue is a symptom that the human body cannot hold due to its higher level of activity. Fatigue can be eased with the consumption of supplements which can also delete the negative effects in various aspects of sports performance including physical resistance, strength and cognitive aspects.

The capacity of essential amino acids for fighting fatigue, beyond the barriers of performance, is when the consumption of these amino acids (Fernstrom, 2005) can reduce the synthesis of brain serotonin, preventing central fatigue during long training sessions.

Moreover, the consumption of essential amino acids prevents the liberation of serotonin in mice (Gómez-Merino et al., 2001). Besides, studies drawn up with human beings showed that the oral consumption of these substances can reduce the perceived effort ratios and mental fatigue in extreme sports conditions, together with an improvement of the cognitive functions after long-distance races.

Another possible explanation for the absence of functionality in sports-people due to the non-administration of essential amino acids is the emerging of an excess of hyperammonaemia as an oxidation of those amino acids (Meeusen et al. 2006). This process was demonstrated by the brain consumption of the ammonia accumulation in humans during long training sessions (Nybo et al., 2005), which implied a central fatigue caused by alterations in the acceleration of the energetic metabolism and neurotransmitters (Wilkinson et al., 2010). Furthermore, we can affirm that the contribution of arginine and citrulline as essential amino acids can improve the performance in maximum-endurance exercises by means of the elimination of the NH₃ (ammonia) surplus and reducing the ratio of plasma tryptophan and essential acids.

One of the main components of amino acids is tryptophan which has been used as a precursor of serotonin and it's a neurotransmitter employed for easing ache. The supply of tryptophan has been used to rise the production of serotonin in an attempt for increasing tolerance for pain during intense exercise. Several studies have shown significant improvements in sports-people's functional working time until exhaustion at 80% of the maximum consumption of oxygen, together with significant reductions in the qualification of the perceived effort (Segura y Ventura, 1988). In addition to that, it can be theorised that the supply with arginine is ergogenic because it is a substrate for the synthesis of nitric oxide, a strong endogenous vasodilator that can benefit the blood flow and the capacity for endurance. Several studies carried out with patients suffering from peripheral arterial disease or clinical symptoms of stable angina pectoris proved to have a better capacity for exercise with the supply of arginine supplements (Bednarz, 2004; Cheng, 2001). Apart from those elements, ornithine, lysine and arginine have been used in attempts for increasing the growth hormone, whose main aim was to increase muscle mass and strength. However, although scientists hold limited data, several well-controlled studies (some of them carried out with experimented weightlifters) informed that there were no increases in the levels of the growth hormone or various strength measurements or muscle power (Fogelholm, 1993; Lambert, 1993; Suminiski; 1997).

Although the supply of essential amino acids has already been studied due to its effect in effort prolongation and fatigue relief, the beneficial effect on the sports development, especially with runners, has not been

completely clarified yet. The aim of this study is to examine the effects after the ingestion of an amino acid's supplement with absorption patterns and its relationship with performance in a maximum stress test.

MATERIALS AND METHODS

The essential amino acids used in our study were supplied by VtiOBest (Alicante, Spain). This product is composed of tryptophan, arginine and lysine among other elements. These essential amino acids with genetic absorption system enable the body protein synthesis. Besides, they have a high nutritional value. This supplement (Table n°1) is absorbed during the first 20 minutes after its ingestion.

Table 1. Composition of the supplement

Composition	16 (g)	100 (g)
GFS Aminos	10 g	60 g
-Leucine, valine, isoleucine, lysine, threonine, phenylalanine, arginine, methionine, tryptophan, histidine.		
-Pyridoxine hydrochloride (Vit.6)		
Energetic Value	0.33 mg 43.44 Kcal=181.77 kJ	2 mg 261.71 Kcal=1095 kJ
Fat	0 mg	0 mg
Carbohydrates	4.81 g	28.97 g
Proteins	0.00 g	0.00 g
Salt	1.88 mg	11.31 mg
Pyridoxine hydrochloride	0.33 mg	2.00 mg

Subjects

Thirty-two experienced sportsmen, (age 34 ± 6.5 and; height 178.5 ± 4.5 cm; weight 72.6 ± 8.6 kg) participated in this study, being excluded all the nutritional supplement and prohibited the intake of alcohol and tobacco. These sportsmen were firstly told about the purpose and the experimental procedure of the study, having the written document with the consent in front of them. This study was approved by the ethics committee of Kinetic Performance, Co. (Parque Científico, Universidad de Alicante) and carried out following the principles of the Declaration of Helsinki.

During the first meeting, the subjects were introduced to the objectives and design of the study and were also instructed on nutrition and rest regimes. The subjects were asked not to do any other physical activity during the recovering period and some days before the test they were told to maintain their habitual diet during both tests. This diary consisting of 72 hours of nutrition that was completed during the first test; the subjects were asked to keep the same diet during the second test. The subjects obtained the informed written consent after the explanation of the purpose and the experimental procedures of the study. The aerobic capacity of the subjects was measured during a continuous increasing test until exhaustion, not inferior to 5 days earlier ($VO_{2max} 63,4 \pm 2,7 \text{ ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$ $46,6 \pm 6,3 \text{ ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$). The subjects were previously analysed following the ISAK method (International Society for the Advancement of Kin-anthropometry) in order to determine their anthropometric parameters, their percentage levels of muscle mass, bone mass and fat mass

per segments. Additionally, they consumed lemon-flavoured drink without being informed of the type of drink it was.

Physical and cognitive performance

Aerobic power (VO₂max) was the selected physical-performance measure to evaluate the percentage of work. VO₂ max was measured by using the increasing-stress test. That test included a 4-minute warm-up followed by a continuous speed increasing of 0.1 km /h every 6 seconds until reaching volitional fatigue (Abrantes-Pereira da Silva, V.A. et al., 2007). The criteria employed for verifying that the VO₂max was achieved consisted on a relation of breathing exchange higher than 1.1 at a maximum heart rate of 220 ± 10 heartbeats per minute and a plateau in the absorption of oxygen with increasing workload (all the criteria had to be followed). For measuring the exchange of pulmonary gases, a portable analyser was used (Metalyzer Sport, CORTEX Biophysik GmbH, Germany). Prior to each test, the equipment was calibrated according to the set of recommendations specified by the supplier.

In addition to that, the jumping height was checked with a Squat Jump (SJ) test by using a *Bosco* jumping platform with three measurements per subject before and after the maximum-stress test. The last of the tests that was carried out consisted on a cognitive-reaction test.

Biochemical analysis

With the aim of measuring the variables of Potassium (Na), Sodium (K), Calcium (Cl), Urea (U), Myoglobin (X) and blood creatine kinase (CK) we took several blood samples by using serum collection tubes and a 3ml urine jar, later, those samples were analysed with a biochemical analyser (Vitros Eci Ortho, EEUU). At the same time, we measured the concentration of blood lactate. This analysis was carried out through a capillary-blood extraction that was analysed in order to measure the concentration of lactate following the measuring principle (LOD enzyme electrode method) with a lactate analyser (Lactate Pro2, Germany). All those parameters were evaluated by Kinetic Performance, S.L: (Alicante, Spain).

Experimental design

Twenty minutes before the test, the subjects from the control group (n=16) consumed the essential amino acid's supplement with absorption pattern dissolved in water, in an amount of 16.6 g of supplement dissolved in 140 ml of water. On the other hand, the subjects from the placebo group (n=16) only consumed lemon-flavoured water. For this study we used the protocol by Kenechtle et al (2011), in the same way, the contributions by Ohtami et al. (2001) were also taken into consideration when we analysed that the long-distance runners who had taken 2.2g of amino acids significantly improved their biochemical parameters. Another study kept in mind was the one by Howatson et al. (2012) when we determined that amino acids provided before physical exercise diminish the muscular damage and accelerate recovering in endurance exercises.

The subjects were asked to do an increasing test until abandonment caused by fatigue. At the end of the test we analysed different venous blood samples in order to detect the biochemical variables, together with a measuring of their anthropometry and a lactate measurement through a capillary-blood collection. In addition to that, at the end of the increasing test, the athletes did a jumping test with 3 attempts. They adopted a static position on 110 degrees during 5 seconds in order to execute the jump. When the knee was in the initial position, measured with a goniometer, it was when the test started. The instrument employed for this test was the jumping platform Ergo Tester. The subjects were evaluated through a cognitive test (Stroop test) 15 minutes after finishing the jumping test. The cognitive test was done on a computer. In order to control the possibly confusing effects caused by individual variations, we used a double-blind random design, with

separate tests from one another for 7 days and following a modified version of Bruce's protocol for stress tests (Abrantes-Pereira da Silva et al., 2007).

Statistical analysis

The Shapiro-Wilk test was used to verify the normality distribution. The data were presented as mean and standard deviation (mean \pm DE). Parametric and non-parametric statistics in both a rational group and among groups, together with this, we did comparisons accordingly. We applied correlation analyses in order to research the effects of the essential amino acids supplement supply in the variables of functional time and the changes in anthropometry. Apart from that, we calculated Cohen's f^2 as a suitable effect sample size that could be applied to the multiple regression context to estimate the relative importance of the differences between the two groups. We applied Fisher's test for categorical data when evaluating the effect of the essential amino acids supplements' supply on the subjective estimation of the result. The statistical significance was established at a level of $p < 0.05$ for all comparisons.

RESULTS

The data from this study (expressed as mean \pm a standard deviation) per group and treatment, are shown on Table 2.

Table 2. Effects of the supplement in athletes

Variable	GT-Pre (means)	GC-Pre (means)	GT-Post (means)	GC-Post (means)
Urea	30 \pm 4.5	29 \pm 7.3	32 \pm 0.6	35 \pm 5.9
CK	85 \pm 9.1	124 \pm 2.2	132 \pm 2.6	195 \pm 4.1
Sodium	136 \pm 6.3	128 \pm 9.3	157 \pm 5.5	191 \pm 2.0
Potassium	4.7 \pm 8.5	5.8 \pm 3.7	5.9 \pm 0.7	6 \pm 7.4
Chlorine	95 \pm 9.6	83 \pm 4.7	123 \pm 2.8	112 \pm 4.8
Osmolality	295 \pm 2.8	315 \pm 5.1	326 \pm 4.0	345 \pm 3.9
DHL	145 \pm 5.4	162 \pm 6.9	175 \pm 8.2	183 \pm 8.6
PH	5 \pm 8.2	4.8 \pm 2.8	5.8 \pm 3.6	6 \pm 6.1
Haemoglobin	31 \pm 8.1	33 \pm 9.7	35 \pm 9.4	36 \pm 0.7
Body fat	13 \pm 2.6**	12.6 \pm 1.1	12.5 \pm 2.8**	12.3 \pm 2.6
Average jumping height	36.10 \pm 3.97**	28.48 \pm 2.21**	32 \pm 3.61	20 \pm 7.41**
Cognitive Test	85 \pm 0.6	89 \pm 5.2**	83 \pm 0.8	76 \pm 7.3**
Average Time	18.6 \pm 7.2**	17.5 \pm 3	18.2 \pm 5.6**	15.3 \pm 0.4

** $P < 0.05$

The absorption of the amino acids differs depending on their ingredients, the dose ratios are important for determining the levels of absorption before physical exercise (Jäger et al., 2013), also taking into consideration the ideas derived from the study by Miller et al. (2002) when we established that the combination of proteins and carbohydrates as supplement improves endurance exercises.

Physical and cognitive performance

The finishing average time (\pm SD) of the subjects that had used essential amino acids before the test was 18.6 min, while the athletes who had not used essential amino acids finished in 16.3 minutes.

The 2.3 minutes average difference in the racing time between the two groups was statistically significant ($p=0.033$). The race time was significantly associated with the duration of the test in the pre-test stage for the control and supplementation groups who obtained Pearson's correlation coefficients of 0.77 and 0.88 respectively ($p < 0.05$ for both of them). Due to the differences of similar means in the racing time, we carried out a regression control for the personal time of the stress test. The difference in the resulting average time was of 2.3 minutes, together with a lower loss of average functional time of the athletes who had consumed the product.

In the cognitive test (Srtoop Test) the treatment group maintained their attention at a better extent than the control group who obtained significant differences in $p < 0.05$, a higher loss than the treatment group, which evidences the continuous cognitive attention by the subjects who had consumed the supplement.

In the same way, as regarding the athlete's fat percentage, the treatment group obtained higher improvements than the control group according to the pre-test and post-test measurements. Apart from this, regarding the average jumping height, the treatment group maintained a higher loss of height compared to the control group.

DISCUSSION AND CONCLUSIONS

The study reveals significant differences ($P < 0.05$) in the performance over the length of the stress test, and a higher loss of average jumping height, together with a lower loss of cognitive attention and a decrease in the fat percentage, according to Christensen et al. (2002) when it was determined that the essential amino acids must be part of the Kenyan long-distance runners and athletes diet (Rusu et al., 2016) also taking into consideration that, on the other hand, the use of supplements may cause doping (Tscholl et al., 2010). To conclude, an amino acids supplement with absorption patterns Gfs Aminos can improve sports-people's performance in relation to functionality and accelerate the use of body fat.

CONFLICT OF INTERESTS

The authors declare to have no interests. The contributors for this study were: Pérez-Turpín, J. A. who designed the experiments, Elvira-Aranda C., who did the statistical analyses. Gomis-Gomis, M. J. and Pérez-Suárez, P. who participated in the realisation of the methodology and all the authors who wrote this manuscript, reading and approving the final article.

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