Effects of Creatine and Glutamine Supplements in Comparison with Proper Nutrition on Performance Factors of Wrestlers

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ABSTRACT

**Aim:** The aim of this study was to investigate the effects of glutamine and creatine supplements and proper nutrition on hand grip strength and agility of athletes. **Materials and Methods:** The samples for this study consisted of 28 elite wrestlers of Mazandaran province, aged 18 to 25 years old. They were randomly divided into four groups. Proper nutrition with carbohydrate solution made of 5% honey instead of water, creatine supplement group (0.3 g/Kg/ for 15 days), glutamine group (0.3 g/kg for 15 days), control group. After a usual warm-up exercises for 15 minutes, for the agility test, 9x4 agility test was performed and following a 10-min rest period, subjects used hand grip for the grip strength test; after 15 days of glutamine and creatine supplements and proper nutrition consumptions, the physical performance tests were conducted in the same condition. Statistical analyses were performed using SPSS software. **Results:** Statistical analysis of the grip strength and agility in post test showed significant difference between the proper nutrition, in comparison with the control group (p<0.05). Therefore, it seems that through proper nutrition (which provides all necessary substances for an elite athlete) there is no need for these supplementation agents and the proper nutrition can be used as an alternative for these supplements. **Conclusion:** Our current investigation showed that proper nutrition can be used as a competent alternative for the common supplements such a creatine and glutamine.

**Key words:** agility, grip strength, glutamine, creatine, wrestling

Introduction

In recent years, many athletes have turned to use nutritional supplements including creatine and glutamine to enhance their performance. It has been claimed that creatine increases muscle strength, and by delaying fatigue, improves the athletes’ ability to exercise harder and gain higher muscular performance in which their muscle can perform beyond normal capability [1]. It seems that plasma concentration of glutamine in athletes is higher than the normal or none-athlete counterparts. However, the concentration of glutamine may decrease during intense exercise or over-exercise periods. For example, it was reported that concentration of glutamine in trained healthy athletes is within the same range as that reported in non-athletes [2]. However, over-exercised athletes showed a reduction in this value as much as 30 %. In a study which was conducted on 5 male athletes that experienced endurance exercises for 10 consecutive days, progressive decrease in plasma concentration of glutamine was observed [3]. Some studies demonstrated that very low level of glutamine in plasma can result in weakening of immune system of the athletes. Wrestling is a sport with weight categorization rules and because of the nature of wrestling competitions and total duration of each match, different energy systems are involved in performing this sport. Nutrition during exercise, competition, and weight reduction phase, have very effective results on the performance of a wrestler [2,3].

Therefore, the possible question might be: Is it really necessary to use nutritional supplements such as creatine and glutamine and will these supplements be effective or necessary for improving the performance of the athletes? Or if athletes learn how to have a proper nutritional diet and to take it effectively, will they gain the same physical performance and benefits. Is it possible to replace the creatine and glutamine supplements with a special proper nutrition?

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The aim of this study was to investigate the effects of glutamine and creatine supplements and proper nutrition on hand grip strength and agility of athletes.

Methods and Materials

The samples for this study consisted of 28 elite wrestlers of Mazandaran province, aged 18 to 25 years old. They were randomly divided into four groups. The first group, called the proper nutrition, consumed a special nutrition program consisting of 55-60 %carbohydrate, 25-30 % fat, and 10-15 % protein. They took carbohydrate solution made of 5 % honey instead of water. The second group, creatine group, took creatine supplement at the rate of 0.3 g/Kg/ for 15 days. The third group, glutamine group, took glutamine supplement with the rate 0.3 g/kg of bodyweight /day for 15 consecutive days. The fourth group was the control which did not receive any supplements or honey drink. After a usual warm-up exercises for 15 minutes, the participants work with a bicycle ergometer with the maximum power up to the point of complete exhaustion and then physical tests were carried out. For the agility test, 9x4 agility test was performed and following a 10-min rest period, subjects used hand grip for the grip strength test; after 15 days of glutamine and creatine supplements and proper nutrition consumptions, the physical performance tests were conducted in the same condition. To determine differences within groups’ changes dependent t-test was used and for between groups one-way ANOVA was used and if it was significant the Tukey test was performed to clarify the intra-group differences. Statistical analyses were performed using Excel and SPSS (version 15; SPSS, Inc., Chicago, Ill.) and significance level of 0.05 was used for all statistical tests.

Results:

Analysis of grip strength variable showed a significant difference in the proper nutrition and creatine received groups. Also, statistical analysis of grip strength in post-test step showed significant difference between proper nutrition and control group. Analysis of the agility variable showed a significant difference in proper nutrition, creatine, and glutamine groups as compared to the control group.

Analysis of the hand grip strength variable showed that the mean values of this variable in post test in the proper nutrition and creatine received groups increased significantly as compared to the pre test measurements (p<0.05) (Table 1, figure1)

Table 1: Analysis of the hand grip strength variable in nutrition, creatine, glutamine and control group.

<table>
<thead>
<tr>
<th>Experiment groups</th>
<th>p-value (Sig.)</th>
<th>Degree of freedom</th>
<th>Paired t value</th>
<th>M±SD</th>
<th>Steps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proper nutrition</td>
<td>0.000</td>
<td>6</td>
<td>6.019*</td>
<td>68.85±5.13</td>
<td>Pre-test</td>
</tr>
<tr>
<td>Creatine</td>
<td>0.005</td>
<td>6</td>
<td>5.806*</td>
<td>56.85±3.38</td>
<td>Pre-test</td>
</tr>
<tr>
<td>Glutamine</td>
<td>0.587</td>
<td>6</td>
<td>5.527</td>
<td>61.00±5.16</td>
<td>Post-test</td>
</tr>
<tr>
<td>Control</td>
<td>0.103</td>
<td>6</td>
<td>3.286</td>
<td>65.57±8.05</td>
<td>Post-test</td>
</tr>
</tbody>
</table>

Fig. 1: Comparison of the hand grip strength and agility values in nutrition, creatine, glutamine and control group.

Also, comparison of grip step variable in post-test step showed a significant difference in the creatine group in comparison with the control and glutamine received groups (p<0.05) (Table 2).

These findings draw parallel to the findings of the anthropometric measurement studies. Ones nutritional status will lead to specific levels of body mass, which in turn has been found to correlate directly to grip strength. This simple method of non-invasive measurement may provide nutritionists and medical professionals with valuable screening data prior to further more invasive testing.
Also, comparison of the agility variables in post-test analysis showed significant differences in proper nutrition, creatine, and glutamine received groups in comparison with control group.

Analysis of variables (Table 3, figure 1) revealed that there was a significant difference (p<0.05) in the agility values, between the pre- and post-test in the proper nutrition, creatine and glutamine groups.

Also, there was a significant difference (p<0.05) between post-test data of the proper nutrition, creatine and glutamine received groups in comparison with control group (table 4).

Table 2: Comparison of grip step variable in post-test step.

<table>
<thead>
<tr>
<th>Comparison of groups</th>
<th>Correct Nutrition</th>
<th>Creatine</th>
<th>glutamine</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correct Nutrition</td>
<td>-</td>
<td>p-value&lt;0.05</td>
<td>p-value&lt;0.05*</td>
<td>p-value&lt;0.05*</td>
</tr>
<tr>
<td>Creatine</td>
<td>p-value&lt;0.05</td>
<td>-</td>
<td>p-value&gt;0.05</td>
<td>p-value&gt;0.05</td>
</tr>
<tr>
<td>Glutamine</td>
<td>p-value&lt;0.05*</td>
<td>p-value 0.05*</td>
<td>-</td>
<td>p-value&lt;0.05</td>
</tr>
<tr>
<td>Control</td>
<td>p-value&lt;0.05*</td>
<td>p-value 0.05*</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 3: The agility values, between the pre- and post-test in the proper nutrition, creatine and glutamine groups.

<table>
<thead>
<tr>
<th>Experiment groups</th>
<th>p-value (Sig.)</th>
<th>Degree of freedom</th>
<th>Paired t value</th>
<th>Mean±SD</th>
<th>Steps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proper nutrition</td>
<td>0.129</td>
<td>6</td>
<td>4.232</td>
<td>9.5±0.45</td>
<td>Pre-test</td>
</tr>
<tr>
<td>Creatine</td>
<td>0.755</td>
<td>6</td>
<td>3.368*</td>
<td>9.6±0.53</td>
<td>Pre-test</td>
</tr>
<tr>
<td>Glutamine</td>
<td>0.02*</td>
<td>6</td>
<td>2.571*</td>
<td>9.5±0.38</td>
<td>Pre-test</td>
</tr>
<tr>
<td>Control</td>
<td>0.113</td>
<td>6</td>
<td>1.512</td>
<td>9.7±0.56</td>
<td>Pre-test</td>
</tr>
</tbody>
</table>

Table 4: Comparison of agility values in post-test step.

<table>
<thead>
<tr>
<th>Comparison of groups</th>
<th>Correct Nutrition</th>
<th>Creatine</th>
<th>glutamine</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correct Nutrition</td>
<td>-</td>
<td>p-value&lt;0.05</td>
<td>p-value&lt;0.05</td>
<td>p-value&lt;0.05*</td>
</tr>
<tr>
<td>Creatine</td>
<td>p-value&lt;0.05</td>
<td>-</td>
<td>p-value&gt;0.05</td>
<td>p-value&gt;0.05*</td>
</tr>
<tr>
<td>Glutamine</td>
<td>p-value&lt;0.05</td>
<td>p-value&gt;0.05</td>
<td>-</td>
<td>p-value&lt;0.05*</td>
</tr>
<tr>
<td>Control</td>
<td>p-value&lt;0.05*</td>
<td>p-value&lt;0.05*</td>
<td>p-value 0.05*</td>
<td>-</td>
</tr>
</tbody>
</table>

Discussion:

Hand grip strength is a physiological variable that is affected by a number of factors including age, gender, and body size and so on. The grip strength was reported to be higher in dominant hand with right handed subjects, but no such significant differences between sides could be documented for left handed people. Right and left hand grip strength was positively correlated with weight, height and body surface area. Handgrip strength is necessary for performing activities of daily living which in turn are required to maintain functional autonomy.

Creatine supplement is used to increase the muscle volume, keep body weight, increase in athletes’ endurance, improve burst movements (like weight lifting, sprinting, and wrestling), to burn fat, cure some illnesses and to reduce the recovery time [4].

Izquierdo M et al showed that fatigue in short duration sports is mainly due to low concentration of phosphocreatine rather than accumulation of acid lactic. Thus, researchers suggested that in periodic fast tasks, the use of creatine supplement (due to its facilitating effects on regeneration of phosphocreatine in the rest periods) improves the performance. For example, it has been shown that because of the consumption of creatine supplement, body mass increases and the ability for repetition of speedy tasks was improved [5].

Nutritional status is correlated with handgrip strength. It was found grip strength to be a strong predictor of an individual’s nutritional status. The importance of glutamine in sport nutrition is because of the fact that the whole body of athletes is under relatively high physical and mental pressures, thus athletes need more nutritional compounds (including glutamine) in comparison with the usual individuals. If the amount of glutamine existed in food or glutamine synthesized in body would not sufficient, the performance of the subject would decreased.
Consumption of supplementary substances can compensate the shortage of glutamine supply [6].

Glutamine is not recognized as an essential amino acid but may become conditionally essential in certain situations, including intensive athletic training or certain gastrointestinal disorders. Glutamine plays a pivotal role in a variety of biochemical functions such as protein synthesis, regulation of acid-base balance in the kidney by producing ammonium, cellular energy, as a source, next to glucose [7], nitrogen donation for many anabolic processes, carbon donation, as a source, refilling the citric acid cycle [1]. Nontoxic transporter of ammonia in the blood circulation. The most eager consumers of glutamine are the cells of intestines the kidney cells for the acid base balance [2].

Cox et al observed that creatine supplement consumption, improved footballers’ performance in sprint running which is in agreement with results of present study [7]. The results of another research showed that creatine supplement consumption improved factors which are affected and involved in short and high intensity contractions significantly [8]. However, some researches have indicated that creatine supplement consumption did not improve performance of completely trained swimmers (25, 50, and 100 meters swimming) and sprint runners (20-30, 40-50, and 50-60 meters run) [9,10]. It is important to note that speed and power have close relationship with each other. This means improvement in one factor will accompany by the improvement of the other. In athletes development in speed and power often is along with muscle hypertrophy. Studies have revealed that the consumption of creatine supplements during exercise, increases speed and power of muscles in athletes.

It has been reported that plasma concentration of glutamine in athletes with fatigue signs and over-exercise was 30% lower in comparison with trained athletes and non-athletes in different fields (long distance track races, swimming, rowing, and tennis). However, consumption of glutamine supplement elevates the levels of plasma and muscle concentrations of glutamine up to the clinical levels, but no significant improvement in the symptoms of fatigue (chronic fatigue, sleep disorder, and physical illnesses) was observed in athletes [2]. The proper group consumed a special nutrition program consisting of 55-60 %carbohydrate, 25-30 % fat, and 10-15 % protein. They took carbohydrate solution made of 5 % honey instead of water. In humans and animals, approximately half of stored creatine and glutamine originates from food mainly from meat. It was shown that carbohydrates are the main source of energy in body. For optimal performance, it is important that the glycogen stores (stored form of carbohydrate in the body) are replenished after each work-out. The optimal time to replenish the glycogen stores is during the two hours following an exercise. So rich carbohydrate foods will help to give the edge of increased glycogen stores and prepare the body for the next work-out. Several studies were conducted to evaluate the effectiveness of honey as a proper nutrition, as compared to other popular forms of carbohydrates used by athletes. It has been shown that consumption of honey produced only mild increases in blood sugar and insulin, prevailing over dextrose (glucose, so honey could be an effective pre-workout energy source that does not induce hypoglycemia. Another research showed that honey sustained the blood sugar level over the two hours following the exercise [9].

The predominant carbohydrates found in honey are glucose and fructose; the relative percentages of them depend largely on the floral variety. Different researches suggest that honey is an ideal carbohydrate for athletes based on its low glycemic index, positive metabolic response, and effective energy production. Honey can serve as an effective carbohydrate replacement during endurance exercise [9].

Despite the potential for gain in “performance” from Cr supplementation, it should be noted that the changes in muscle total Cr and PCr caused by Cr supplementation do not mimic any adaptive changes that occur in response to exercise training programs. Neither aerobic, high-intensity resistance, nor sprint training is accompanied by significant changes in PCr, total Cr content, or Cr kinase activity [11,12]. Cr supplementation cannot replace the necessity and value of training for conditioning and/or sport preparation. Further aspects of Cr supplementation should be kept in mind. First, although the performance of muscle is clearly better in the presence of the PCr/Cr system than in its absence [10,13,14], PCr is not “essential” for muscle contraction. ATP is the essential high-energy compound involved in muscle contraction. Second, based on the available evidence, Cr supplementation does not increase the potential energy available from PCr hydrolysis. On the contrary, available studies suggest that the PCr/Cr ratio in muscle decreases after supplementation [15,16,17], which would naively suggest a smaller free energy potential. Because this is contrary to expectations, these measurements from muscle supplemented with Cr are viewed with some uncertainty. Third, although an increase in total Cr content in muscle could result in a greater oxygen deficit [18,13], there is no evidence that Cr supplementation increases the aerobic power of muscle. Thus, the exercise context for potential impact of Cr supplementation seems well defined. Finally, there is no evidence that Cr directly stimulates protein synthesis or alters myosin expression in normal differentiated muscle cells [19,20]. Thus, there is no presently identified anabolic effect of Cr supplementation.
Conclusion:

The group which received the proper nutrition showed more increase in speed and power performance compared to the creatine and glutamine groups. It seems that if elite athletes consume proper nutrition and especially get benefit from honey, there is no further need to use supplements. Finally, from the findings of the present study it can be concluded that the proper nutrition can be used as a competent alternative for the common supplements such a creatine and glutamine.

Transparency Declarations:

Competing interests: none to declare.

References