A Study on the Short-Term Effects of Monohydrate Creatine Supplementation on Athletes

Mohammad Khazaei, Rasoul Golmohamadi, Farzad Nazem, Ahmad Hematfar

Department of Physical Education and Sports Science, Islamic Azad University, Boroojerdi Branch, Boroojerdi, Iran.

ABSTRACT

Nowadays, using food supplements is one of the concerns of coaches and athletes. Sometimes, weak information about this issue and presenting various substances by opportunists companies leads athletes to excessively and uncontrolled use these substances which only endanger their health. At higher levels of sport, there is a narrow border between victory and failure. In a match, participants are distinctive from each other in terms of talent, practice, motivation, and tactics and nutrition is regarded as a highly important factor to achieve desired goal. Over time, athletes’ skill levels have been advanced in various sport fields. Athletes’ records have reached to new peaks and coaches and athletes search for every factor which can, even slightly, increase victory opportunity. In this regard, they may refer to substances or phenomena increasing sport performance, i.e. ergogenic aids.

INTRODUCTION

Using food supplements to optimize sport performance is one of the nutritional considerations which is abundantly used in sport world today. For the first time, creatine was used in 1992 Olympic Games in Barcelona. Among food supplements, creatine is the most commonly used type which is mostly consumed by athletes, particularly power and speeds athletes. Thampson et al. [14] investigated the effect of creatine on aerobic and anaerobic metabolism of muscle in woman university swimmers during 6 weeks exercises. The subjects used 2 g creatine per day. As they found, creatine has no effect on metabolism amount in resting status, metabolism, during the exercise, and return to normal state.

Aaserud et al. [12] observed the positive effect of creatine supplement (5 g per day) on performing repeated sprints in adolescent herbalist men. Johns et al. investigated the effect of monohydrate creatine supplement on speed bicycle and performing squat in elite ice hockey players. In this study, testees consumed 5 g monohydrate creatine or placebo (glucose) during 5 days, 4 times per day and 5 g during 10 weeks. As they concluded, in the group consumed monohydrate creatine, mean power was significantly increased in the speeds of 5×15 s during 10 days of fast loading and 10 days slow loading. Kinogasa et al. did not find any significant difference in speed performance by prescribing 5 g creatine per day during a short term. Chueblinska-Monta explored the effect of creatine supplement on aerobic and anaerobic performance of elite rower men. They observed that creatine supplement improves their endurance (through lactate threshold) and anaerobic performance in elite rowers.

Oma et al. analyzed the effect of creatine supplement on softball women players’ endurance and muscular power who consumed 2 g creatine per day for one week. Accordingly, it was found that consuming supplement improves the mean of endurance and power repeated twitches.

Ohman et al. reported a positive effect of creatine supplement on rugby players’ performance. Ostojic [19] evaluated short-term effect of monohydrate creatine on speed performance of adolescent football players consumed 10 g creatine 3 times per day. As they observed, compared to the control group (placebo), in the experimental group (creatine supplement), dribbling test time, speed power test time, and vertical jump height were improved but no change was observed in endurance test.
Creatine:

Creatine is an ergogenic organic matter which is mostly synthesized in liver; a little amount of creatine is also synthesized by kidneys and pancreas. The amino acids of arginine, glycine and methionine are precursors of creatine synthesis. Creatine also can be obtained from food resources such as meat and fish. Almost 98% of creatine is stored in muscles in free form (40%) or phosphorylated form. Heart, brain and testicles are organs in which creatine is slightly stored. Creatine is transmitted from its origins to muscle through blood circulation system. The natural concentration of creatine in plasma varies from 50-100 mg/ml. Creatine is a natural food matter in animal foods. It is said that creatine is an effective ergogenic food matter which is useful in exercises performance or endurance exercise. As the previously reported studies showed, consuming monohydrate creatine may increase total creatine (TCR) including both free creatine (FCR) and phosphor creatine (PCR). As previous studies suggested, using laboratory tests including alternative repeated exercises with limited and short recovery period between the repetitions, creatine supplements may increase performance in high intensity and short exercise tasks (depending on the primary level of PCR). As reported, in short time, creatine supplement increases men’s body mass through increasing body water. Regarding physical exercise including endurance exercise, creatine supplement may increase fat free mass. However, further information is required for fixing it. Consuming creatine for 8 weeks is not related with a main health risk. But its long-term effects have not been yet proved. Creatine is a common legal supplement used by athletes and it is not regarded doping anyway. Creatine was found in 1835. France reported that creatine is abundantly found in meat and increases the performance of athletes. Meanwhile, it has been claimed that consuming creatine leads to the increase of power, the decrease of performance time and the increase of muscle mass. Creatine is of the amino acids of arginine, glycine and methionine in kidney, lung and pancreas and it is abundantly found in muscle. Creating is in the two forms of 40% free (cr free) and 60% phosphorylate (cp). Although creatine supplement (cr) is abundant in fast-twitch muscle fibers, in slow-twitch muscle fibers, their aerobic capacity’s remix ability is increased. As revealed, there is no significant difference between men and women in terms of creatine. Also, it does not seem that exercise influences creatine. Creatine plays four roles during performance, including energy buffer, time buffer, spatial energy buffer, and praptono glycosylation buffer. Consuming 20 g creatine per day for at least 3 days leads to a significant increase in total creatine. It is believed that the increase of crfree and pc concentrations helps performance through providing energy in short terms and well increase remix amount during alternative resting periods. Apparently, creatine supplement cannot help exercises like endurance and incremental exercises. In some studies, the effects of creatine in short-term exercises with high intensity have been ambiguously reported. The only lateral effect of creatine is a slight increase in body mass, leading to maintaining water or increasing protein synthesis. Fusal involves high-intensity alternative exercises that cause a heavy pressure on glycogen stores of muscle and liver. Therefore, carbohydrate rejection leads to fatigue and the decrease of performance during a futsal match. Moreover, fatty acids origin uses both adipose tissue and intramuscular three glyciner resources. When players participate in a match or exhausting exercises, they should encouraged to a full carbohydrate diet (55% of total energy consumed). Additionally, during and after a futsal match, a carbohydrate drink can increase the performance and help the improvement of return to normal state and reconstructing glycogen in muscle and liver. Creatine supplement is an ergogenic contributor in performing sports by athletes. Excessive consumption of creatine has had a normal trend among athletes of different sports during the recent years. Creatines supplement increases creatine and phosphocreatine concentration in muscle, enhances the amount of ATP regeneration and creates a lag in the onset of fatigue and recover facilitation during high intensity and alternative exercises. The advantages of consuming creatine in elite athletes are related to the increase of ability in high-intensity alternative repetitions during exercise or match in sports that need repetition such as futsal, football and basketball.

In the form of phosphocreatine (Pc), creatine has an ignorable role in energy metabolism. Pc is a substance participating in ATP formation through ADP re-phosphorylation. Pc performs this act especially in very high intensity and short-term sport activities. The speed of ADP re-phosphorylation depends on creatine kinase.

The Research Objective:
The research objective is to compare short-term effects of monohydrate-carbohydrate creatine and monohydrate creatine supplements on fatigue index of young footballists.

The Research Hypothesis:
The research hypothesis can be stated as follows:

“There is no significant difference between the effects of monohydrate-carbohydrate creatine and monohydrate creatine supplements on fatigue index of young footballists”.

The purpose of the present study is to compare short-term effects of monohydrate-carbohydrate creatine and monohydrate creatine supplements on fatigue index of young footballists in Sanandaj City. In this regard, a brief review on theoretical principles is presented and then, the general findings of the study are discussed.
enzyme and Pc accessibility. Rejecting Pc stores leads to the decrease of the ability to perform very high-intensity sport activity. The following cases are roles suggested for Pc in muscle:

- Stimulating ADP phosphorylation through decreasing creatine kinase (the man ATP regeneration source in very intense short-term physical activity);
- Increasing the capacity of high-energy phosphates transmission from mitochondria (ATP synthesis source) to ATP consumption laces (e.g. myofibrils);
- Participating in neutralizing intracellular acidosis during physical activity (that is why, it has been suggested that pure PC hydrolysis uses hydrogen ions);
- Activating glycogenolysis and other catabolic paths using PC hydrolysis products (e.g. creatine and non-organic phosphate).

Using Creatine as Supplement:
The average PC phosphocreatine concentration in muscles is 125 mm for each kg dry muscle; but, this amount can vary in a range between 90 to 160 mm for each kg dry muscle. Compared to men, creatine concentration is higher in women and compared to non-vegetarians, vegetarians have higher creatine concentration. As reported, creatine supplement increased creatine concentration in muscles up to about 20%. It seems that there is a saturation limit for creatine in muscles. Many studies have revealed that as soon as creatine amount in muscle reached to 150 to 160 mm for each kg dry weight, using more creatine supplement does not lead to these amounts. Such an issue has a valuable applications contrast to the philosophy of “the more the better” involving many athletes’ minds. This issue also contributes to the development of appropriate creatine diets. Generally, a creatine diet includes 1 dose 20-25 g loading per day during 5 days. It is continued by consuming 2 g creatine per day. Some people may consume proportional with body weight; in this case, 0.03 g for each kg weight should be consumed in a day. Some athletes may disregard to consume high loading during the first 5 days and use only 3 g creatine in a day from the beginning. Creatine amount of muscle has been identical in both ways; therefore, using the second method prolongs the process of obtaining the same creatine concentration of muscle (almost 30 days against 5 days). As daily consumption (2 g in a day or 0.03 g for each kg in a day) is maintained, muscle creatine amount is highly maintained. As soon as stopping using creatine as supplement, creatine amount returns to the base level after 4 weeks.

Consuming Creatine Supplement and Sport Performance:
It seems that creatine as an ergogenic matter which has been highly investigated during the last years. This issue is probably related with high prevalence of its consumption by athletes and the tendency of medical and scientific community to obtain a better understanding about its advantages and dangers. Apparently, those athletes relying on PC as an energy source for their physical activity fuel (e.g. body builders, sprint runners, footballists, hockey players, and basketballists) more benefit from consuming creatine supplements. Most of studies measured the effect of creatine supplement on power performance always reminded its abundant ergogenic advantages. In a 10-week study on a group of the first class inter-university footballists conducted by Pearson et al., athletes consumed a capsule containing 5 g creatine or a placebo (without using loading stage). Compared to the placebo group, the power in chest press and clean power was highly increased in athletes who consumed creatine. These results revealed probable advantages of consuming creatine as supplement in experienced endurance sport athletes who may have limited power expansion potential. In recreational athletes, consuming creatine for power increase intention may have no advantage. Although considerable power advancements have not been reported in non-competitive athletes, studies have not been able to find any significant difference in power increase. The difference between the two groups may due to the time of consuming creatine by testees. In the first mentioned study, testees consumed creatine for 6 weeks while in the second study, testees consumed creatine supplement only for 4.5 weeks. Since testees in the two studies had identical loading during the first 5 days and then, creatine consumption amount was decreased up to 2 g per day, there is the possibility that the results are related with more exercises time and creatine consumption in the first day. In another study, endurance and non-endurance men athletes consumed creatine and placebo for 12 weeks. Although the power was significantly increased in both groups, testees who consumed creatine showed more power increase up to 8% in chest press and squat. Additionally, there is the possibility that recreational athletes are more able to obtain higher power compared to endurance athletes with a record approached to their genetic power potential. In experienced power athletes, the decrease of fatigue causes the increase of retrieving. This issue can be resulted in more exercise stimulus for muscles. Most of studies tested the effect of creatine supplement on one session of explosive exercise (e.g. sprint or jumping performance) have not revealed any significant progress. However, in some of these studies, testees consumed creatine with one dose of loading during 3 to 5 days. When testees consumed creatine for a long term (28 to 84 days), considerable progresses were observed in power and jumping performances. It seems that when creatine is sued as an exercise supplement, it has more obvious effect on the increase of performance. Consuming creatine supplement may
allow aerobic athletes to have a better exercise session, leading to the improvement of performance. It does not seem that consuming creatine can be so effective in the improvement of performance.

**Creatine Supplement Consumption and the Increase of Weight:**
Generally, long-term creatine supplement consumption leads to the increase of weight. It seems that such an increase in weight is firstly associated with fat-free weight. It is believed that metabolism led to the increase of weight is related to the increase of total body water somehow. Also, it is believed that the increase of muscle creatine increases of intracellular osmosis gradient and causes that cells are filled with water. Moreover, the increase of muscle creatine enhances the synthesis of muscle’s contractile proteins.

**Energy Systems:**
Body muscles needs energy for their contraction; therefore, physiological events such as exercise, growth and repair depend on the energy saved in a chemical compounds called Adenosine three phosphate (ATP).

**Fig. 1:** Releasing Energy from ATP Molecule from ATPase enzyme.

The amount of ATP in muscle is very low in resting state. In fact, while there is only about 100 g ATP in total muscular system, more than 50 kg ATP is consumed during a marathon. Hence, body should continuously produce ATP to continue an exercise. It is achieved through transmitting chemical energy existing in lipid, carbohydrate and proteins.

**Fig. 2:** The Energy Released from Carbohydrate, Lipid, Protein, and Phosphocreatine for ATP Rebuild from ADP and Phosphate.

Some exercises such as sprint, endurance activities, alternative exercises and/or power exercises do not increase the primary concentration of ATP in resting state but they improve he ability of ATP regeneration. If ATP necessary for muscles contraction can be produced, fatigue can be delayed. As soon as facing problem in producing necessary ATP, the process of fatigue begins. Therefore, the primary goal of sport exercises is to maintain the appropriate ATP level in muscles. The ability of ATP regeneration in muscular cells to continue physical activity depends on three types of energy, including phosphocreatine system (CrP), lactic acid system and anaerobic glycolysis of aerobic system or oxygen. Before discussing each system, two points should be investigated, firstly, each of the three energy systems can be simultaneously active in a muscular cell. For example, all the three systems, even aerobic system can be used in the onset of sprint (Figure 2).

The main distinctive feature of the energy systems is the speed of performance and total ATP reconstructed by each of chemical reactions. Assuming that the maximum effort starts from zero time, Figure 1 shows a classic diagram to recognize the energy systems in specific events.
Anaerobic Glycolysis or Lactic Acid System:

Anaerobic glycolysis which is sometimes called lactic acid system depends on 13 chemical reactions to change glycogen to lactic acid. This system is only able to consume carbohydrates (glucose or glycogen) while lipids and proteins can be only used by oxygen. As glycogen is an appropriate fuel, lactic acid is the final product of anaerobic glycolysis. Energy released during changing glycogen to lactic acid is used for ATP reconstruction. Compared to required single chemical reaction, 13 stages of anaerobic glycolysis needs more time to change accessible energy to release energy from CrP. However, energy production path in these reactions is very faster than those reactions produced energy through aerobic system. That is why, sprint runners depend on anaerobic glycolysis to complete CrP limit storage during sprint. Longer sprints (more than 20 minutes) depend on anaerobic glycolysis to produce more energy.

Aerobic Energy or Oxygen-Based System:

Aerobic system which has been also recognized as oxygen energy system can provide necessary energy only when oxygen is near to muscles. When oxygen is accessible, carbohydrates and proteins can be broken within mitochondria. Compared to glycolytic path, aerobic chemical reactions more slowly act; however, energy resulted from aerobic path is considerably more accessible than the two anaerobic paths. Slower ATP regeneration in this system derives from the necessity of fuel transmission between various cellular parts. Aerobic system depends on oxygen release and transmission from lungs which is controlled through blood flow from heart to lungs and its return to heart and then to muscles. These stages take much of time such that sprint runner have not so much time but an endurance athlete has enough time. Endurance runners mostly make use of aerobic system. Endurance systems not only increase the ability of body to provide necessary oxygen to active muscles, but the capacity of muscles is also improved to apply oxygen in mitochondria. Furthermore, players of a team who require the period of return to normal state need an appropriate aerobic system to clear lactic acid and improve return to normal state. All the energy systems try to maintain appropriate ATP level.

Table 1: A Summary of Energy Systems and Their Characteristics

<table>
<thead>
<tr>
<th></th>
<th>Aerobic Energy System</th>
<th>Oxidative or Aerobic System</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Anaerobic Glycolysis</td>
<td>Lactic Acid System</td>
</tr>
<tr>
<td></td>
<td>Very fast</td>
<td>Fast</td>
</tr>
<tr>
<td></td>
<td>Fuel: PC</td>
<td>Fuel: Glycogen</td>
</tr>
<tr>
<td></td>
<td>Limited ATP production</td>
<td>Limited ATP production</td>
</tr>
<tr>
<td></td>
<td>In the primary stages, two speeds or every short-term activity (up to 20s) is used</td>
<td>In intense activities, durations of 30s to 2minutes are used</td>
</tr>
</tbody>
</table>

Aerobic and Anaerobic Energy Sources:

Energy released from food analysis is not directly used by muscles, but it is stored as a high-energy molecule called ATP in muscular cells. Energy released from ATP analysis is the only energy source for muscular work. When ATP is analyzed, a great amount of energy (about 7.6 kilo calorie from each ATP) is released. In addition to ATP, muscular cells have another high-energy matter called cp and pc. Unlike ATP, energy released from pc analysis is not directly used for muscular works, but, ATP regeneration cases cells always have access to high-energy molecules. Carbohydrates are another anaerobic energy sources. In body, all carbohydrates are changed in a simple sugar called glucose which can be consumed in the same way and/or stored for the next usages in the form of glycogen in liver and muscles. Releasing energy from glucose analysis is another ATP production which is named glycolysis. In endurance activities, carbohydrates are an appropriate source for aerobic path and provide the energy necessary to maintain muscles activity. Carbohydrate shortage in diet causes inadequate glycogen storage in muscles and liver, leading to inability of maintaining appropriate blood glucose level and enough energy for muscles activity. In this state, athletes suffer from fatigue, deconcentration, return to the primary weak mode, and nausea.

For the first time, Harris et al. asserted that consuming monohydrate creatine can increase total creatine in muscle including creatine and phosphocreatine. In this study, consuming 5 g creatine in during several days, each day 4 times, causes the increase of creatine concentration (about 20% to 30%).

Green half et al. observed a 6% improvement of sport performance in maximal repetitions of physical activity after consuming 20 g creatine during 5 days. After this study, to achieve the improvement of sport performance as a result of consuming creatine, further studies were conducted by Baclon et al., Biritch et al., Harris et al., and Wolk et al.. In 1999, the effect of creatine consumption on the improvement of performance in high-intensity physical activities was analyzed in 62 laboratory. 42 tests were reported positive and the rest were reported neutral.
Methodology:
The present work was a semi-experimental study with independent variable manipulation and pretest-posttest design. In pretest, mean power, peak power and fatigue index (through aerobic exercises) and anaerobic capacity (through aerobic exercises) were compared with the posttest conditions as a result of consuming monohydrate-carbohydrate creatine and monohydrate creatine. The statistical population included 48 Fatalists of Sanandaj City. The population was selected before the start of scheduling table of official matches during on season of regular exercises. Out of 48 people, 16 people were voluntarily selected. The statistical sample was selected using convenient sampling method. The sample was divided into two experimental groups. Therefore, the test was carried out during 4 week. During this period, the players kept far from exhibition matches but they participated in general exercises. The subjects were at the age range of 20 to 30 years. The first experimental group included those who consumed monohydrate-carbohydrate creatine and the second experimental group involved those who consumed monohydrate creatine.

Procedure:
Initially, the subjects warmed up for 5 to 10 minutes with heart rate of about 150 pulse per minute through alternative riding (30s riding and 30s resting) on cycle ergometer with the rhythm of 60 to 80 rounds per minute. Then, the subjects rested for 3 to 5 minutes and started the main test based on total weight as follows:

Hearing the word of “go”, the subject started to ride with the maximum power and speed and when the tester felt that the subjects reached to their peak speed, set up chronometer by applying the considered load (watt). Naturally, reaching to the peak of ridding takes 3 to 4 seconds. The applied load of 75 g for each kg of the subjects’ body weight was selected. From the moment that chronometer started to work, counter recorded the number of ridding every 5 seconds. After the end of the test, the subjects continued to rid for 2 to 3 minute without applying the rhythm of 30 to 50 rounds per minute to return to normal state before the test. Of course, in the second time half, the tester verbally encouraged the subjects to make use of their maximal power and ability.

Measurable parameters in Wingate anaerobic test included the followings:
Mean power or anaerobic power mean is the mean of performed work in 30 s of Wingate test. This variable specifies the capacity of lactic acid metabolic system.
Peak power refers to the highest obtained ability during the first 10 minutes. This variable determines the capacity of active skeletal muscle’s phosphagen system.
Fatigue index is obtained from the following formula:
\[
fi = \frac{(pp - mp) \times 100}{pp}
\]

Performing the Tests:
Firstly, after coordination with the coach of futsal team, 16 players of Sanandaj City were voluntarily selected with the age range of 20-28 and regular sport history of 10 year in clubs. Then, a 4-week selective exercise protocol including general and specific warm up, aerobic power exercises (general endurance), anaerobic power, and power and flexibility. The exercises were planned in 4 regular 90-minute sessions. During these session, the subjects consumed a determined amount of creatine. The first group (8 people) consumed monohydrate-carbohydrate creatine complement and the second group (8 people) consumed monohydrate creatine supplement during two loading stages. Before and after the treatment, two anaerobic tests of 30-minute ridding with the maximum power on cycle ergometer-specific to Wingate test were performed. Aerobic test of running on treadmill was performed on the subjects up to fatigue threshold with the interval of 48 hours. The first experimental group consumed 20 g monohydrate-carbohydrate creatine supplement 4 times a day (one hour before lunch, two hours before exercise, immediately after exercise, and one hour before night sleep at 10 o’clock) during 5 successive days (loading period). The second experimental group consumed the same amount of monohydrate creatine supplement per day. During maintaining period, both groups consumed the supplement one time in a day (5 g). The players’ program containing 4 weeks regular weekly exercise was used as the exercise protocol. All the exercise stages were held in afternoon 4 to 6. The subjects used their normal diet. Additionally, during the program, the subjects were kept away from nutritive materials in the main meals and snack with vegetable or animal source similar to the supplements in their diet under the supervision of nutrition exnt. The names of some of these materials similar to the supplements in the athletes’ diet are as follow:

For each kg of body weight, 2.5 g protein; for each kg of body weight, 4.5 g carbohydrate and 10% of total consumed food has been allocated as the natural sugar (date and fig) and 3% should be allocated as fat (fish oil and olive oil). Therefore, the nutrition program of athlete used their normal diet was written during one week and the names of some of the materials similar to the supplement in the daily diet of the athletes were asked and written and the food value consumed by the subjects during one week was changed in kilo calories (Table 2).
The average food value received during the investigated weeks was 2402.25 (with standard deviation of 242.97) and 2261.5 (with standard deviation of 105.51) in the monohydrate-carbohydrate creatine group and creatine group, respectively.

Exercise program included general and specific warm up, aerobic power exercises (general endurance), anaerobic power, and power and flexibility. During the 4 weeks, the athletes exercised using weight in 6 sessions under the supervision of the coach. The required instruments included conoid, ball and hurdle. The activity was performed using ball and without ball during the 4 weeks.

To describe the obtained data, mean and standard deviation was used; to investigate the data normality, K-S test was used; to test the research hypothesis, paired sample t-test and independent t-test were performed before and after the treatment. All the statistical analyses were performed through SPSS software. The significant level of 0.05 was considered to analyze all the statistical hypotheses.

**Testing Hypotheses:**
1. There is no significant difference between the effects of monohydrate-carbohydrate creatine and monohydrate creatine on fatigue index for young futsallists.

To investigate the short-term effect of monohydrate-carbohydrate creatine and monohydrate creatine on fatigue index for young futsallists, the pretest and posttest of the two groups (consumed monohydrate-carbohydrate creatine and consumed monohydrate creatine) were compared using paired t-test. In case of lack of significant difference between pretest and posttest of the two groups, the short-term effect of creatine on fatigue index is rejected and the hypothesis is confirmed.

**Fatigue Index (Minimum Power Output):**
Investigating the minimum power of the subjects in the two groups in pretest and posttest revealed that the mean peak power of foot in the group consumed monohydrate-carbohydrate creatine was 196.88 with standard deviation of 116.13 in pretest and 188.5 with the standard deviation of 53.69 in posttest. In the group consumed creatine, the mean peak power of foot was 265.21 with standard deviation of 92.09 in pretest and 293.03 with standard deviation of 65.37 in posttest. Also, observed t-value was 0.2 with degree of freedom of 0.847 in monohydrate-carbohydrate creatine and – 1.505 with degree of freedom of 7 in the creatine group at the significance level of 0.176. Since the significance level is greater than 0.05, the null hypothesis is confirmed, indicating the lack of significant difference in the minimum power between pretest and posttest.

Table 3: The Comparison of Minimum Power in Pretest and Posttest.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Group</th>
<th>Stage</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>T-Statistic</th>
<th>Degree of Freedom</th>
<th>Sig.</th>
<th>Variation Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum Power</td>
<td>Monohydrate-carbohydrate creatine</td>
<td>Pretest</td>
<td>196/8</td>
<td>116/1</td>
<td>0/2</td>
<td>7</td>
<td>0.847</td>
<td>-0.043</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Posttest</td>
<td>188/5</td>
<td>53/6</td>
<td>-1/505</td>
<td>7</td>
<td>0.176</td>
<td>0.105</td>
</tr>
<tr>
<td></td>
<td>Monohydrate creatine</td>
<td>Pretest</td>
<td>265/2</td>
<td>92/09</td>
<td>-1/505</td>
<td>7</td>
<td>0.176</td>
<td>0.105</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Posttest</td>
<td>293/03</td>
<td>65/37</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

![Variation changes of the minimum power](image-url)
However, using the formula of variation change, the difference between the two groups was computed more precisely such that for each of the participants, the variation change was computed and the obtained values were processed in SPSS software. Then, the difference between the two groups was obtained using column chart. Using the following formula, the difference degree of the monohydrate creatine and monohydrate-carbohydrate creatine was 0.1 and -0.04, respectively.

**Conclusion:**
1. There is no significant difference between the effects of monohydrate creatine and monohydrate-carbohydrate creatine on fatigue index of young futsallists.
2. There is no significant difference between the effects of monohydrate creatine and monohydrate-carbohydrate creatine on anaerobic power mean.
3. There is no significant difference between the effects of monohydrate creatine and monohydrate-carbohydrate creatine on anaerobic peak power.
4. There is no significant difference between the effects of monohydrate creatine and monohydrate-carbohydrate creatine on aerobic performance of young futsallists.

Considering the research findings, it is concluded that consuming supplement has no effect on peak anaerobic power, minimum anaerobic power, mean anaerobic power, and aerobic power.

**REFERENCES**


