The Effects of a New Six-Week Resistance Exercise Program and Supplementary Nutrition on the Increase in Strength and a 1-Repetition Maximum Exercise of Chest Press in Elite Weight Trainers

Farzin Dehghani*
Master of Arts of Exercise Physiology, Faculty of Sport Sciences, University of Isfahan
Hazar Jerib Ave., Azadi Sq. 81746-73441 Isfahan, Iran. Phone number: 983137932571

Seeid Mohammad Marandi
Full Professor, Department of Exercise Physiology, Faculty of Sport Sciences, University of Isfahan
Hazar Jerib Ave., Azadi Sq, 81746-73441 Isfahan, Iran. Phone number: 983137932571

Jalil Reisi
Assistant Professor, Department of Exercise Physiology, Faculty of Sport Sciences, University of Isfahan
Hazar Jerib Ave., Azadi Sq, 81746-73441 Isfahan, Iran. Phone number: 983137934282
*Corresponding Author: tiger.farzin@yahoo.com

Abstract

The pyramid is one of the advanced training systems in the field of body building and fitness that used for hypertrophy and muscular volume increase. The goal of this study was to examine the effect of the pyramid system and Consumption of creative mono-hydrate and carbohydrate Protein supplements on increasing the muscular strength and 1-repetition maximum.

Methodology: for this purpose, 29 of the elite Pressers of Esfahan province were selected as samples and were randomly divided into two groups of experimental and control groups. 72 hours before the first exercise and 72 hours after the last exercise session they were taken a record for their chest press using 1-repetition maximum.

Findings: the findings of this study showed that there was a significant difference between the first control and experimental groups after going through a six-week resistance exercise program. However, there was no difference between the second control and experimental groups (P > 0.05) and the level of progress in the first experimental group was higher than in the other two groups (P < 0.05).

Results: it seems that the combination of the pyramid system and creatine supplements and carbohydrate protein mixtures causes an increase in muscular strength and 1RM in elite weight lifters and using pyramid system alone without the consumption of any food supplements has no effect on muscular strength in the elite weight lifters.

Keywords: Chest Press, Monohydrate creatine, Carbo-hydrate Protein, pyramid system.
**Introduction**

Resistance exercises are the mother exercise in all fields of sports and the bench press is one of the basic exercises of these. This exercise is a multiple-joint and compound exercise which requires involvement of many muscles (1, 2). Creatine monohydrate is a common food supplement in the world of sports which is used frequently by the athletes of various fields. Over the past two decades, most researches have been focused on creatine while studying ergogenic substances. Creatine is not in the list of doping substances of National Olympic Committee. In human's body, creatine is made of arginine, methionine and glycine amino acids of 1 to 2 grams per day. A little amount of creatine is in the food we eat which leads to the daily of absorption of 0.25 to 1 gram of it mainly skeletal muscles which include about 95% of the creatine storages. The total rate of creatine in our body has been estimated to be approximately 120 grams (3-9). In early 1980, when anabolic steroids became infamous, factories started to make a product which was supported by the customers even better than anabolic steroids were. However, the majority of people did not have a positive view towards it. But over the past years, the views of most athletes have changes because effective food supplements entered the market one of which is creatine monohydrate. While high doses of steroids were not effective, creatine was. In addition, it didn't have any of the side effects of anabolic drugs. Creatine helps increase muscle mass and leads to more provision of energy and quicker regain of energy after exercising (10). The main mechanism of creatine's effect is helping the cell increase the speed of turning ADP\(^1\) into ATP\(^2\). Increase of total muscle phosphocreatine and levels of free creatine and therefore making of supplements might not lead to functional impacts in a stage of short-term quick activity or at the time of resistance activities such as the marathon. Nonetheless, creatine supplement and the increase caused by it in the total muscle creatine might lead to improvement of function in some cases where phosphocreatine storages are discharged and also so much lactate along with reduction of ATP. Some examples of such cases are semi-endurance and speed exercises for about 30 to 180 seconds and also intense periodic exercises such as repeated speeds at the time of interval exercise sessions or sports of the interval type. Examples of such trainings are ice hockey, rugby, soccer and repetition of a set of exercises with lift just like what is usual in the exercise sessions of weightlifters. It has been shown that creatine monohydrate supplements of 20 to 30 grams per day for 4 to 5 days increase the mean of total muscle creatine for 25 to 35% (11). Poortmans, et al., in their studies, came to the conclusion that short-term and long-term consumption of creatine has no bad influences on livers and other parts and organs of the human body (11). Carbohydrate is the most important foodstuff for intense heavy athletic performance. The energy released from carbohydrate is three times quicker than the energy released from fat. In total, body's carbohydrate storages are not much and this limits the duration of athletic activities with high intensity (12, 13). Other than reduction of performance, discharge of carbohydrate leads to the increase of consumption of amino acid for energy to be produced and this leads to production of ammonia which leads to tiredness. When protein is used for producing energy and is turned into glucose, it leads to the destruction of muscle tissue. Eating carbohydrates before, during and after exercising leads to a more optimal consumption of body's carbohydrates and reduction of protein consumption and production of ammonia and defers

---

1 Adenosine diphosphate
2 Adenosine triphosphate
tiredness and leads to the improvement of athletic performance (14). Carbohydrate sources which shall be used after an intense athletic activity shall have a high sugar index and be consumed with sufficient fluids for them to be absorbed quickly (15, 16). Providing carbohydrate for improving the performance is not only recommended for endurance runners or bikers; but it also improves performance in many short-term intense and repeated sports as well (17). However, about protein, it shall be said that sufficient consumption is needed for growth of muscles and for the muscle damages to be repaired which have been created through athletic activities and enzymatic adaptability (18, 19). The need for protein in athletes is more than normal and non-athletes. Endurance athletes require 1.2 to 1.8 grams of protein for each kilogram of their weight and power athletes need 1 to 1.2 grams of it for each kilogram of their weight (16, 20).

Previous researches in the field of effect of creatine and carbohydrate and protein on athletic performance includes a research done by Donyayi, et al. (2013). The purpose of that research is to compare the effect of acute consumption of ribose supplement and creatine monohydrate on anaerobic performance (maximum power, mean power and tiredness index) after an intense activity in elite wrestlers. The results showed that maximum anaerobic power and average anaerobic power depend on consumption of ribose supplement and creatine monohydrate but tiredness does not depend on the consumption of ribose supplement and creatine monohydrate (21). The purpose of another research done by Garajian, et al. (2011) is to review the effect of creatine monohydrate on the function of muscles and power of female students who are athletes. The results show that consuming creatine monohydrate supplement has led to increase of the whole function and to the improvement of the performance of the muscles of the participants but it does not affect nonfat mass (22). Kreider, R. B., et al. (1999), in a research, reviewed the impact consumption of creatine monohydrate supplements and carbohydrate – protein supplement as a combination on the muscular strength and body composition of male soccer players not in the game season. The results showed that consumption of these supplements leads to the increase of muscular mass and muscular power (3). Deldicque, et al. investigated the impact of consumption of carbohydrate – protein on expression of genes associated with the synthesis of protein of skeletal muscles in their research and the results showed that consumption of these supplements leads to the increase of the gene expression related to protein synthesis (23). The pyramid exercise system is one of the most common patterns of increasing the number of times the exercise is done. When it reaches its maximum, the number of repetition of each set will also be reduced in proportion with this. Physiological advantage of this method is making sure of activity or main callback of motor units. There are various pyramid patterns such as: the pyramid, the double pyramid, cross pyramid and flat pyramid (2). Hosseini, et al. (2012) compare the effect of two patterns (the double pyramid and diverse pyramid) on muscular strength and muscular volume and they did not observe a significant difference between the impact of these two methods on muscular volume and strength (24). Fish, et al. (2003), by comparing two exercise methods the pyramid and the diverse pyramid, reported a similar increase in 1RM and 10RM strength (25). Burger, et al. (1962) reviewed the effect of one, two, and three sets of exercise with 2, 6, 8 times of repetition in each set three times a week on 20 athletes in 12 weeks with the purpose of increasing the muscular power in the bench press exercise and ultimately, they came to the conclusion that doing three sets with 6 repetitions is the best method for increasing muscular power (26). Although using fixed lifts in each time of
exercise applies the desirable load and tension to the muscle, with this method, few repetitions in each set might also prevent effective exercise stimulation by limiting the volume of exercise and the time that muscle is under tension (MUT\textsuperscript{3}) and by reducing other stimuli such as tiredness (27). The purpose of the present research was to compare the usage of pyramid exercise system without consuming creatine monohydrate and carbohydrate – protein supplements and usage of pyramid exercise system by consuming creatine monohydrate supplements and compound of carbohydrate and protein.

**Research method**

The research method in this study is a semi-experimental one and it has been a field study. The statistical sample includes 29 of the elite pressers of Isfahan province with the average age of 24.58±2.12 and the average weight of 87.86±6.46 which were the criteria for their selection and entrance (being elite, competition, championship, at least a record of three years of exercise and so on) who were selected randomly. They were divided into three groups. One was an experimental group (10 persons) who consumed creatine monohydrate supplement and a compound of carbohydrate and protein and used the pyramid system in their exercises and the second group was also an experimental group (10 persons) whose members did not consume any kind of supplement but used the pyramid system in their exercises. The third group was a control group (9 persons) who did not use any kind of supplements and did not use a pyramid system and did their previous and desirable exercises.

Firstly, the research subject, purpose and method were orally explained to the participants. Then the subjects signed a written consent for participating in the research. The duration of this protocol and consumption of food supplements was six weeks. 72 hours before the first exercise session, the records of each three group in the bench press exercise was reviewed by using 1 repetition maximum test and 72 hours after the last exercise session this was done as well.

Consumption of creatine monohydrate in the first experimental group was in such a way that each athlete consumed 20 grams of creatine per day as load with four meals in the first five days and 10 grams with two meals in the other days. The consumption of carbohydrate – protein food supplement has also been in such a way that 1.5 carbohydrate for was consumed for each kilogram of the body weight immediately after the exercise and 0.53 gram protein was consumed for each kilogram of the body weight of each athlete and till 6 hours after the exercise, each two hours this supplement is consumed like before (10). The pyramid system which was used in this research was in such a way that each athlete consumed 20 grams of creatine per day as load with four meals in the first five days and 10 grams with two meals in the other days. The consumption of carbohydrate – protein food supplement has also been in such a way that 1.5 carbohydrate for was consumed for each kilogram of the body weight immediately after the exercise and 0.53 gram protein was consumed for each kilogram of the body weight of each athlete and till 6 hours after the exercise, each two hours this supplement is consumed like before (10). The pyramid system which was used in this research was in such a way that the athlete did the maximum number of times in each set with the specified lift that he could bare in the bench press exercise and the weight of the lift was increased in each set so that it would reach 1RM and he did that with the maximum number of times as well.

A repetition maximum test (1RM): in this test, six moves are measured including bench press, leg press, and biceps, pulling the pulley device from the back of the neck, stretching the knee and bending the knee. 1 repetition maximum is the maximum weight of a lift which is moved only once before the athlete is tired. The purpose of this test is to measure motor (dynamic) muscular power through measuring the maximum lifted weight and only the ability of doing this exercise once. Approximately, a repetition maximum (maximum power) can be calculated through the formula below (28).

---

\textsuperscript{3} Muscle under tension

The Lifted Weight

$$1 - 0.02 \text{ (repetition)}$$

The exercise program used in this research on each week:

**Saturday:**
Barbell bench press 100% - 95% - 90%×2 - 85%×2 - 75% - 65%
Dumbbell bench press 2×5 - 2×7
Barbell incline 3×5
Barbell decline 2×4 - 2×6
Lying barbell triceps 5 – 7 – 9
Standing barbell triceps 3×7
Dip device triceps 3×7

**Sunday**
Dumbbell shoulder press 5-5-7-9
Barbell front raise 3×7
Dumbbell lateral raise 2×5 - 2×7
Bent over one-hand raise 3×8
Barbell shrugs 3×8
Cable biceps 3×9
EZ barbell biceps 4×7
Dumbbell biceps 3×6
Lift crunches 3×20
Spatial workout 3×12

**Monday**
On this day no work out is done and the athlete is absolutely at rest.

**Tuesday**
On this day the exercise program for Saturday is used.

**Wednesday**
On this day the exercise program of Sunday is used.

**Thursday**
Wide-grip lat pull down 6 – 8 – 10 – 12
Bent over barbell canoeing 5 – 5 – 7 – 9
Dumbbell one-handed canoe stretch (alternate) 3×8
Parallel hands t-bar 7 – 9 – 11
Back exercise with devices 3×11

**Friday**
Resting: on this day no exercise was done.
In this exercise program, bench press has been done in such a way that the athlete does 65% of 1RM, 75% of 1RM, 85% of 1RM in two turns, 90% of 1RM in two turns, 95% of 1RM and 100% of 1RM with the maximum of the number of repetitions. However, for other exercises, in each turn, the maximum weight which can be lifted with the specified number of repetition is used. In this exercise program, the number of repetitions and turns of exercise was power-based
and hypertrophy or a combination of the two but the purpose of this research is to increase muscular power. The time of resting between the exercise turns has been 4 to 5 minutes.

Results and findings
In this section, we analyzed the collected data based on the descriptive statistics including mean and standard deviation of the sample. The results associated with the research hypotheses are reviewed by using the Kolmogorov-Smirnov test for assessing the normality of the data and Levin test in order to homogenize the variances and then test the ANOVA variance and Sheffe test.

Table 1 – results associated with the normality of the data for the rate of improvement

<table>
<thead>
<tr>
<th>Protocol</th>
<th>Group</th>
<th>Testing Z-statistic</th>
<th>Significance level</th>
</tr>
</thead>
<tbody>
<tr>
<td>First group (creatine + carbohydrate + protein)</td>
<td>1.341</td>
<td>0.055</td>
<td></td>
</tr>
<tr>
<td>Second group (without supplement)</td>
<td>1.121</td>
<td>0.162</td>
<td></td>
</tr>
<tr>
<td>Third group (control)</td>
<td>1.249</td>
<td>0.088</td>
<td></td>
</tr>
</tbody>
</table>

The significance level obtained for the rate of improvement variable in each three protocol has been calculated to be more than 0.05. Therefore, the data collected in the research is normal.

Table 2 – features of participants and Levin test

<table>
<thead>
<tr>
<th>Protocol</th>
<th>Group</th>
<th>Protoc Group</th>
<th>Significance level</th>
</tr>
</thead>
<tbody>
<tr>
<td>First group (creatine + carbohydrate + protein)</td>
<td>5.75±2.37</td>
<td>0.3</td>
<td>0.743</td>
</tr>
<tr>
<td>Second group (without supplement)</td>
<td>0.25±2.19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Third group (control)</td>
<td>-0.28±4.04</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Since the significant level has been calculated to be more than 0.05, it can be concluded that each three group is homogenous in terms of the rate of dispersion in this protocol.

Table 3 – rate of improvement in protocol for the three groups

<table>
<thead>
<tr>
<th>Stage</th>
<th>Standard deviation ± mean</th>
<th>F-Value test</th>
<th>Significance level</th>
</tr>
</thead>
<tbody>
<tr>
<td>First group (creatine+ carbohydrate + protein)</td>
<td>5.75±2.37</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Second group (without supplement)</td>
<td>0.25±2.19</td>
<td>12.631</td>
<td>0.000**</td>
</tr>
<tr>
<td>Third group (control)</td>
<td>-0.28±4.04</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Significance at the level of 0.01

Given table 3 and graph 1, there is a significant difference in the rate of improvement of the sample between the three groups in this protocol.
Given the results of table 4 and since the significant level has been obtained to be less than 0.05, there is a significant difference between the first group and the third group and the rate of improvement in the first group has been significantly more than the third group.

<table>
<thead>
<tr>
<th>Group</th>
<th>Step</th>
<th>Difference of means</th>
<th>Significance level</th>
</tr>
</thead>
<tbody>
<tr>
<td>First group (creatine + carbohydrate + protein)</td>
<td>Second group (without supplement)</td>
<td>5.50</td>
<td>0.001**</td>
</tr>
</tbody>
</table>

** Significance level of 0.01

Given the results of table 5 and since the significant level has been obtained to be less than 0.05, there is a significant difference between the first group (consumption of supplement) and the second group (lack of supplement consumption) and the rate of improvement in the first group has been significantly more than the second group.

<table>
<thead>
<tr>
<th>Group</th>
<th>Step</th>
<th>Difference of means</th>
<th>Significance level</th>
</tr>
</thead>
<tbody>
<tr>
<td>First group (creatine + carbohydrate protein)</td>
<td>Third group (control)</td>
<td>6.03</td>
<td>0.001**</td>
</tr>
</tbody>
</table>

** Significance level of 0.01

Given the results of table 6 and since the significant level has been obtained to be less than 0.05, there is a significant difference between the second group and the third group and the rate of improvement in the second group has been more than the third group but this difference has not been significant.

<table>
<thead>
<tr>
<th>Group</th>
<th>Step</th>
<th>Difference of means</th>
<th>Significance level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Second group (lack of supplement consumption)</td>
<td>Third group (control)</td>
<td>0.53</td>
<td>0.927</td>
</tr>
</tbody>
</table>
Discussion and conclusion

There are lots of studies and researches which show that creatine monohydrate and compound supplement of carbohydrate – protein along with endurance exercises can lead to muscle building, to provision of the fuel needed for endurance sports and can create energy and ultimately lead to the improvement of performance and advancement in that particular sport field. The purpose of the present research is also to review the impact of pyramid exercise system and consumption of creatine monohydrate and compound supplement of carbohydrate and protein on the increase of muscular power and muscular mass and the results showed that there is a significant difference between the first experimental group and the two other groups. However, there is no significant difference between the second experimental group and the control group. Zuniga, J., et al., (2012), Antonio, J., et al., (2013), Pearson, D., et al., (1999), Larson and Meyer (2000) and Law, Y., et al., (2009), in their researches, solely used creatine or used it along with other food supplements for increasing muscular power and volume and the results of their researches are compatible with the results of the present research (29-33). The results of the researches of Chromiak, J., et al., (2004) and Kreider, et al., (1999) also comply with the results of the present research in which creatine monohydrate and carbohydrate – protein food supplements are used as a combination (3, 34). Roni, et al., (1994) expressed that when an athlete is tired, he used more motor units. That is why as the muscular activity continues, these stimulations lead to the increase of power. This is evident in the pyramid lifting pattern which has been used in this research (35). Stroski, et al. (2003) have compared a 6, 3 and
12 repetition program with one another and found out that the three used volume have positive results in increasing the 1RM power but the difference was not significant between various groups after 10 weeks of exercise (36). As it was mentioned in the introduction, Hosseini, et al., (2012) and Fish, et al., (2003), in their researches, came to the conclusion that using the pyramid and the double pyramid and the diverse pyramid system without consuming food supplements leads to the increase of muscular power (24, 25) and their results are not compatible with the results of the present research. The cause of this incompatibility is that in the mentioned studies, is that elementary and inexperienced athletes have been used who are at the beginning and have not reached the peak of their improvement in the field of muscular power and the speed of their improvement is high and they respond positively to many of the exercise systems. But in the present research, professional, elite and experienced athletes have been used who have been exercising for years and reached the peak of their improvement and the speed of their improvement has slowed down a lot or it has stopped and the exercises will create positive results if they are combined with desirable food and proper food supplements. In this protocol, using the pyramid system along and without consumption of food supplement was not much useful and it only led to the increase of muscular power and 1RM in the bench press move when it was used along with creatine monohydrate and carbohydrate – protein compound supplements because in such exercises and sports, the dominant system is energetic phosphates and using creatine monohydrate also leads to the reinforcement of this system and it causes the athlete to have more energy in the exercise session and have a better performance and overcome the weight of heavier lifts. Using creatine monohydrate postpones tiredness and accelerates recreation of energy sources in between exercise sessions and leads to the increase of the volume and intensity of the exercises. When the exercises are done with more intensity, the muscles are under more pressure and tension and muscular rupture is more likely and the additional lift principle is considered in some way. Now, in order to repair muscle fibers and to increase muscular volume, protein is needed which is created by amino acids. Along with protein, carbohydrate is also consumed whose responsibility is to provide energy and amino acids build muscles because if there is not enough carbohydrate available, amino acids are used for energy production and muscular degeneration precedes muscle synthesis. Also, body's a=lack of access to carbohydrate cause it to use protein to produce energy which leads to the production of ammonia and leads to the increase of tiredness. Therefore, eating carbohydrates along with protein leads to the reduction of protein consumption and production of ammonia and postpones tiredness and leads to the improvement of performance. Also, eating carbohydrate and protein increases the secretion of anabolic hormones (synthesizing muscular proteins) and reduces the secretion of catabolic hormones (degenerating muscular proteins). Ultimately, eating carbohydrate and protein increases the muscle building process. In fact, protein has an important role in building and repairing the tissues and that is why it is especially important for endurance athletes and body builders. Intense work leads to degeneration of muscular tissues, therefore the athlete will need more protein than its natural rate so that he would be able to repair these damages and to increase muscular mass. At the time of intense periods, insufficient absorption of protein is the reason that the rate of degeneration of protein is more than the rate of its synthesis which leads to the reduction of protein tissues. This means that hours of hard work out can lead to reduction of size and power of the muscle. In order to prevent this, it is necessary for the body to consume sufficient amount of protein so that the muscle will be allowed to grow properly.
Increase of the rate of blood amino acids, in addition to consumption of foods filled with protein, can be due to the increase of the rate of growth hormone and insulin. Although the increase of these hormones leads to the increase of the rate of amino acids, it simultaneously leads to the reduction of muscle catabolism and leads to the increase of anabolic responses as well. The results have shown that digestion of BCAAs moderates the environment and situation of the hormones. Some information indicate that methionine, glutamine, tryptophan and isoleucine amino acids have anabolic effects: they increase the creation of protein for repairing and improving muscular wounds. Protein consumption post exercising has anabolic effects due to the increase of the level of growth hormone and insulin. Increase of the rate of accessible amino acids directly affects the creation of protein especially in the first few hours after the work out. Naturally, the speed of creation and degeneration of protein and transmission of amino acids after the work out are increased and selecting any of them depends on the accessibility of the amino acids. If the accessible amino acids increase after the work out, the speed of degeneration is reduced. In other words, the speed of creation of protein is more than the speed of its degeneration and increase of cellular contractile proteins is its outcome. Therefore, it is necessary to increase the rate of absorption of amino acids immediately after the work out. Secondly, foods that are absorbed will lead to creation of protein through increasing the release of insulin because insulin directly stimulates creation of muscle protein and in some cases it reduces protein degeneration (38). creatine’s function is as follows:
1. It maintains a proper level of ATP through repeated phosphorylation of ADP of phosphocreatine. This function is particularly important in transferring from rest to work out such as intense short-term performances.
2. It supports the shuttle of creatine phosphate. Free creatine and creatine phosphate increase exchange of energetic phosphate from transport of mitochondria to the cytosol. Thus, the ATP produced through oxidative metabolism inside the mitochondria can meet the need for energy in the cytosol at the time of intense non-aerobic activities and intense glycolysis associated with it.
3. Phosphocreatine tampons hydrogen ions and that is how it will help reduction of acidosis in the muscle cells. Phosphocreatine hydrolysis consumes hydrogen ions.
4. Products of the degeneration of phosphocreatine – nonorganic phosphate and free creatine help adjust the activation of carbohydrate degeneration processes (glycolysis) in the muscle.
5. Creatine can stimulate the creation of muscle protein which leads to the increase of the size of muscle fiber and net body mass. The evidences show that the reaction of creatine kinase in the muscles loaded from creatine is facilitated. That is why at the time of intense muscular contractions, ADP intracellular accumulation is inhibited. Therefore, formation of the IMP and AMP is inhibited or reduced. Thus, adenine nucleotide is lost (39). So, it is concluded that doing the pyramid exercise system alone and without consuming creatine monohydrate food supplement and a carbohydrate – protein compound do not lead to the increase of muscular power in the bench press exercise in elite weightlifters and this technique shall be used as well as creatine monohydrate food supplement and a carbohydrate – protein compound for increasing the muscular power.
References


