

The Effects of Creatine Monohydrate on 1-RM Bench Press

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Abstract

Abstract. Johnson, S., Knopps, D., Miller, J., Gorshe, J., Luzinski, C. The Effects of Creatine Monohydrate on 1 R. M. Bench Press. *J. Undergrad. Kin. Res.* 2006; 1(2): 8-14. Synthesized in the liver, pancreas and kidneys, the amino acid creatine is broken down to provide the body short bouts of energy. The purpose of our study is to determine if creatine supplementation in the form of pure pharmaceutical-grade creatine monohydrate will increase strength gains in performance weightlifters. This study consisted on testing eight males, ages 21-28, and the effects of creatine supplementation during a 4 week workout program. Data from this study was collected to compare pre and post 1-RM bench press along with correlation between body weight and amount of supplementation taken. Results from this study showed a substantial increase of 6.8 kgs/**15 lbs** in 1-RM. bench press over a 4 week span, along with a slight correlation in body weight and amount of supplementation consumed. The most important finding in this study was that creatine supplementation coupled with a resistance training program will increase 1-RM bench press in college age males.

Key Words: Resistance Training, Strength Gains, Supplementations, Ergogenic Aids, Exercise,

Introduction

In 1996 three out of four Olympic weightlifting medalists had one major thing in common. That was they all took creatine as a supplement for their weight training. "Creatine is an amino acid derivative that occurs naturally to a small extent in the human body. Approximately 2% of total body Cr is synthesized in the liver, pancreas and kidneys...found primarily in skeletal muscle, creatine in its free and phosphorylated forms plays a crucial role in skeletal muscle energy metabolism." (1) Creatine was first discovered in 1832. By 1923 scientists found that almost all of creatine was stored in muscles. Many foods such as salmon, tuna, and beef have high levels of creatine, but the best way to get creatine is in its pure form. Creatine is an amino acid in the form of phosphocreatine and is broken down to create energy used for intense short bouts of expenditure. Every person has certain amounts of creatine stored in their muscles but scientists found that muscles can store additional creatine. "Uptake of creatine into skeletal muscle may stimulate transcription factors that control protein synthesis or increase

phosphocreatine stores, which may allow for greater amount of work performed during individual training sessions.”(2).

Since studies have shown that human muscles have room for extras creatine deposits, many theories exist claiming that additional creatine intake will enable muscles to increase workload. Creatine supplementation has also been shown to enhance fat-free mass, and physical performance. (3)The purpose of our study is to determine if creatine supplementation in the form of pure pharmaceutical-grade creatine monohydrate will increase strength gains in performance weightlifters. It will be hypothesized that creatine intake will increase muscle strength shown through a 1-RM bench press.

Methods

Subjects:

The subjects studied were males ages 20-26 in presumably overall good health. Subjects were selected by convenience sample with a requirement of at least three years of resistance training experience. Necessity of training experience was not limited to three years of vigorous resistance training, rather, at least a moderate amount of training over a three year span. Subjects were also required to currently be enrolled in a training program for at least 6 weeks prior to testing. They were also required to be free of any amount of creatine supplement for at least one month prior to training. Informed consent was signed by each subject before testing procedures began. This study was approved by the University Human Institutional Review Board.

Males n=9	
Age (years)	23.33 ± 2.29
Height (cm)	180.93 ± 7.00
Weight (kg)	89.41 ± 16.41
Pre-Program 1RM (kg)	104.10 ± 21.17
Post-Program 1RM (kg)	110.97 ± 21.15
Change in 1RM (kg)	6.87 ± 3.44

Instruments:

Our subjects were to complete a pre-test consisting of numerous variables. Height was measured and transferred into centimeters. Weight was taken and transferred into kilograms. Age was also recorded. 1-RM bench press test was conducted using Magnum Fitness Systems 96160.

The most important measurement was bench press 1-RM. For pre-test and post-test bench press 1-RM, subjects were asked to perform 1-RM Testing Protocol. Testing protocol uses a 9 point instructional phase. Prior to testing protocol subjects were asked to not participate in any heavy lifting program. On day of 1-RM Testing Protocol, subjects were also instructed to maintain daily routine and sleep schedule.

- Instruct athlete to warm-up with a light resistance that easily allows 5-10 repetitions.
- Provide a one minute rest.
- Estimate a warm-up load that will allow the athlete to complete 3-5 repetitions by adding 10-20lbs.

- Provide a 2-4 minute rest period.
- Estimate a conservative, near-maximum load that will allow the athlete to complete 2-3 repetitions by adding 10-20lbs.
- Provide a 2-4 minute rest period.
- Make load increase 10-20 lb. Instruct athlete to attempt 1-RM. If athlete was successful, provide a 2-4 minute rest period and go back to step
- If athlete failed, provide a 2-4 minute rest period, decrease the load by subtracting 5-10lb, and then go back to step.
- Continue to complete until the athlete can complete one repetition with proper exercise technique. This protocol was used prior to 4 week creatine supplementation period, and after 4 week supplementation period. (4)

Creatine supplementation has become one of the most popular ergogenic aids among athletes and one of the most profitable for the supplement industry. (5) Three different brands of creatine monohydrate supplementation were used. The brands consumed purchased from GNC are as followed: Xyeince Nox-CG 3, Schwartz Laboratory, Creatine Monohydrate and Pro Performance Creatine Monohydrate. 15 grams were consumed throughout the initial 3 day loading phase. The loading phase consisted of ingesting 5 grams of creatine in the morning, afternoon, and evening. Following the loading phase, subjects were instructed to ingest 5 grams per day, before daily workout program, for the remainder of the study.

Procedures:

After all pre-test data was collected; subjects were instructed to take creatine supplement and continue with their regular work-out program. The most important concept of this study was that the subjects were not to deviate from their regular work out program or daily diet under any circumstances. Any alteration in these two variables could result in inaccurate results. The subjects were asked to continue with their program for 4 weeks, followed by another 1-RM bench press test.

Statistical Analysis:

A dependant t-test was used to examine the change in 1-RM values from pre-program to post program. Refer to Table 1 and Figure 1 for visual reference. Because the test values were defined by the means and standard error, the significance level was $p = .000$, which was significantly less than 0.05. The Pearson's r correlation was highly positive with a value of .987. Taking into account one outlier, it actually went even higher to a value of .995.

Results: There was a significant difference between the pre-program 1-RM group (M=104.0) and the post-program 1-RM group (M=110.97), $t(9)=.000$, $p<0.05$.

	Pre 1RM (kg)	Post 1RM (kg)	Creatine (g)	Grams per kg	Age (yrs)	Height (cm)	Weight (kg)	Change in 1RM (kg)
1	120.20	134.09	5.00	.0397	20	191.77	126.09	13.89
2	81.65	90.72	5.00	.0698	26	172.20	71.66	9.07
3	79.38	86.18	5.00	.0641	26	177.80	78.02	6.80
4	92.99	102.06	5.00	.0595	26	180.34	83.91	9.07
5	111.03	113.40	5.00	.0543	24	189.23	92.08	2.37
6	88.45	92.99	5.00	.0619	23	177.80	80.74	4.54
7	145.45	150.00	5.00	.0490	21	186.69	102.06	4.55
8	104.33	109.09	5.00	.0626	22	180.34	79.83	4.76
9	113.40	120.20	5.00	.0554	22	172.20	90.26	6.80

Table 1: Pre/Post Subject Data

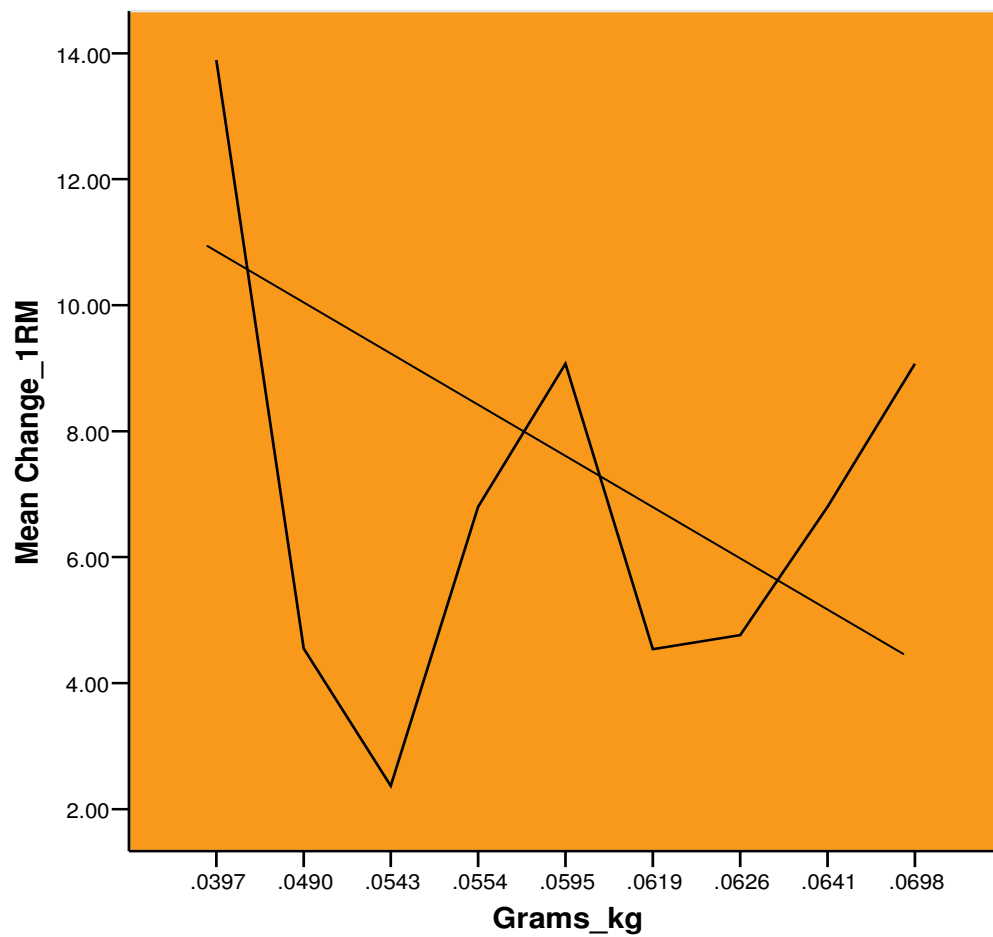


Figure 1: Grams of Creatine per kilogram of bodyweight versus change in 1-RM.

There was no significant difference 1-RM between the subjects with a lower intake of creatine per kg of bodyweight and the subjects with a higher intake of creatine per pound of bodyweight. But we did find a slight correlation between the two. The subjects with a lower intake of creatine per kg of bodyweight seemed to have gained a little more on their 1-RM.

DISCUSSION

Analysis of the data listed above brings us to conclude that we reject our null-hypothesis and accept our research hypothesis that that creatine intake will increase muscle strength shown through a 1-RM bench press.

This study compared the 1-RM bench press of 9 college aged males before and after creatine ingestion. The 9 male subjects that were chosen had previous weight training experience of at least 3 years. During the 4 week study the participants continued their previous personal workout programs for the entirety of the study. The study was conducted in this way so that no new training benefits could be linked to the introduction of a new training stimulus to the body. The subjects ingested a 15g dose of creatine for a 3 day loading phase and 5g thereafter on both workout and rest days. Upon completion of the 4 week program the subject's 1-RM bench press was again recorded following the previous 1-RM protocol. After the completion of the study it was evident that all nine of the subject's 1-RM bench press increased from their original 1-RM. The average increase of 1RM was 6.9 kg in the individuals that took part in the study.

We also looked at one of the subjects as a possible outlier. He gained 13.89 kg possibly because of his type of training. If we took his values out of the study, our mean change in 1 RM vs. Grams of creatine per kilogram of body weight would change drastically. It would actually tip in favor of taking a higher dose of creatine per pound of bodyweight. The correlation would be a slightly positive one instead of a negative one.

Recent studies have suggested that consuming 5g or more of creatine could significantly improve strength in 1-RM. In a study done in *Medicine & Science in Sports & Exercise* the researchers stated "...Cr supplementation resulted in significant increases in peak force and total force." (1) An additional study printed in *Medicine & Science in Sports & Exercise* also reported "In general, strength improved for the Cr group for all three lifts (bench press, power clean and squat) with increases of 5.2%." (6) A study reported in *The Journal of Family Practice* also stated that "the creatine supplementation group showed an absolute strength increase of 6.85 kg. (7) The results of these studies coincide with our results. The increase of 6.85 kg reported in the study in *The Journal of Family Practice* is in direct comparison to an increase of 6.8 kg reported in this study. A study by Becque & Melrose concluded "1RM for Cr increased ($P < 0.01$) from (mean \pm SD) 42.8 \pm 17.7 kg to 54.7 \pm 14.1 kg, while 1RM for Placebo increased ($P < 0.01$) from 42.5 \pm 15.9 kg to 49.3 \pm 15.7 kg. At post-test 1RM was significantly ($P < 0.01$) greater for Cr than for Placebo."(8) There have also been studies conducted that are in contrast to the results shown in this study. A research article in *Medicine & Science in Sports & Exercise* reported that "Cr supplementation did not result in any improvement in upper-body maximal strength" (9)

The findings of the study can be beneficial to male college athletes of all sports who want to increase their overall strength. It provides athletes with information that can aid their workout experience. However, due to the average age of the participants, the information can only be generalized to that specific population. More studies should be done to determine the benefits of creatine supplementation for different age groups as well as genders.

One particular study that we think would be very interesting and beneficial is the supplementation of creatine in older adults. Our University has an adult fitness program that could perform this study during the program. One of the positive effects of creatine is that it helps in muscle recovery. One thing that we've come across while working with older adults is that muscle soreness is a major factor in their adherence to a workout or training program. And *if* we could convince them to try creatine supplementation, we believe that they would be more motivated to stick to a training regimen because of a lower instance or shorter duration of post-workout muscle soreness.

Limitations:

Due to the limited number of individuals that participated in this study more research needs to be conducted to determine the actual efficiency of creatine as a supplement. Factors such as the training stimulus used and individual diet are possible variables that could have influenced the results of the study.

CONCLUSION

The most important finding in this study was that creatine supplementation coupled with a resistance training program will increase 1-RM bench press in college age males. This study is very useful to college athletes that are interested in gaining strength. It may also be useful to recreational weight lifters that are looking for a way to help in their strength gains. It is specifically applicable to the population that was studied, and should not be generalized to other populations until further research is conducted to determine the benefits and side-effects of creatine use in other genders and age groups.

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