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Does Creatine Monohydrate Result into an Increase of Weight?

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ABSTRACT

Cr supplements have shown to be an ergogenic aid to increase body weight and change in body composition. The purpose of this study was to demonstrate creatine's ergogenic effect on increased weight gain, due to water concentrations. Each mouse was subjected to swimming exercise 15-minute period daily for the next 6 weeks. Mice were randomly divided into two groups: Complete diet with excessive protein supplementation 0.05 g.day (CON, n = 5) and complete diet with Cr supplementation 0.001g.day and excessive protein supplementation 0.05 g.day (CR, n = 5). After each exercise body weight was determined in grams. Following the 6 week period, the animals were killed by cervical dislocation and the gastrocnemius (GN) was dissected from each mice. Each GN was weighed, then each mice muscle was divided into 3 replicates of 3/10 the muscle mass for moisture determination. The CR group's body weight increase was statistically significant compared with the CON group ($p < 0.05$), as both show significant increase ($p < 0.05$). However, there was no statistical difference between CR and CON group over the 6-week period of time ($p > 0.05$).

Keywords: *Creatine, Body Composition, Weight Gain, Water Retention, Dietary Supplementation*

INTRODUCTION

Creatine is an amino acid-like substance naturally stored in muscle and nerve cells. Normally creatine is acquired through regular dietary meals such as meat and fish. Creatine monohydrate is the synthetic form of creatine, which is synthesized by the liver, kidney and pancreas from the amino acids, arginine, glycine and methionine, to produce phosphocreatine (PCr). PCr plays a key role in the energy source provided for muscle cells. During explosive or high intensity workouts, PCr is hydrolyzed or broken down by donating its phosphate group to adenosine di-phosphate (ADP) to form adenosine tri-phosphate (ATP). This reaction allows a rapid ATP turnover providing energy to sustain maximal muscle contractions. Cr metabolism is excreted by the kidneys at a rate of approximately two grams daily (Terjung, 2000). In recent years, Cr supplements have shown to be an ergogenic aid to increase body weight and change in body composition (Rawson, 2007). Although, the underlying basis of this weight gain is still unclear. It may be due to stimulation of muscle protein synthesis or water retention in the initial days of creatine supplementation (Yildiz, 2009).

Creatine monohydrate has become a popular dietary supplement among professional, elite, collegiate, amateur and recreational athletes to enhance body weight and fat-free muscle mass. Prior to creatine becoming a popular dietary supplement many studies claimed that creatine increased fat-free muscle mass and body weight. However many point out that this weight gain is a possibility of stimulate protein synthesis, but is most likely due to water retention (Juhn, 2003). Weight gain, due to the intra- and extracellular water retention, has raised skepticism as to the ergogenic potential of creatine in mass-dependent sports such as running and swimming (Juhn, 2003). Water weight would give the athlete no ergogenic benefit and/or a disadvantage by harming his or her performance.

I sought to achieve substantial change in water concentrations of Swiss mice, following 6 weeks of dietary Cr supplementation. Moisture content was determined by the muscle wet mass compared to the dry mass, the loss in drying method was moisture.

The purpose of this study was to determine whether creatine's cause of weight gain, is a result of the increased hydration of muscle cells. I hypothesized that 6-weeks of Cr supplementation would increase skeletal muscle water retention in mice.

MATERIALS AND METHODS

McPherson College approved this study. Twenty-five 3-week old newborn female Wobbler mice were kept in standard individual plastic cages with free access to food and water, under a controlled 12hr light/12hr dark cycle and a temperature of 22 degrees Celsius, for food intake and body weight determination. Two months later, the remaining mice were randomly divided into two groups: Complete diet with excessive protein supplementation 0.05 g.day (CON, n = 5) and complete diet with Cr supplementation 0.001g.day and excessive protein supplementation 0.05 g.day (CR, n = 5).

Each group was subjected to swimming exercise 15-minute period daily for the next 6 weeks. Over the next 6 weeks CR group was given Cr supplementation 30-minutes before exercise and both CR and CON group were given protein supplementation immediately following exercise. After each exercise body weight was determined in

grams. Following the 6 week period, the animals were killed by cervical dislocation and the gastrocnemius muscle (GN) was dissected from each mice. Each GN was weighed, then each mice muscle was divided into 3 replicates of 3/10 the muscle mass for moisture determination

Moisture content determination was adopted from Soxhlet Method of loss in drying. As mentioned above, three replicates of 3/10 the muscle mass were taken. They were weighed and recorded (M). Samples were placed on a glass crucible, put to dry in the oven at 102 C for 5 hours and immediately re-weighed after drying to record weight (M2). The percentage weights of moisture content of the samples were determined as M2 subtracted by M, divided by the original weight, multiplied by 100. Statistical analysis of body weight was performed by a Multivariate Analysis of Variance test and a t-test was performed to

RESULTS

The body weight of all experimental animals was similar initially. However, all groups gained weight by the end of the experiment. At the 30th day, CR group body weight set itself apart from the CON group. In the CR group, body weight increase was statistically significant compared with the CON group ($p < 0.05$), as both show significant increase ($p < 0.05$). However, there was no statistical difference between CR and CON group over the 6-week period of time ($p > 0.05$).determine significance of moisture content.

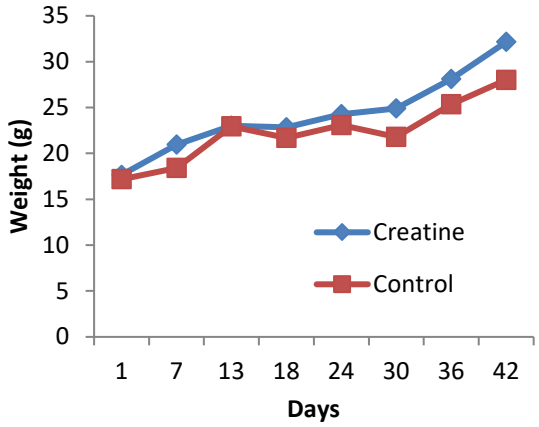

Figure 1. Showing body weight in control vs. creatine group mice over 42 days of study

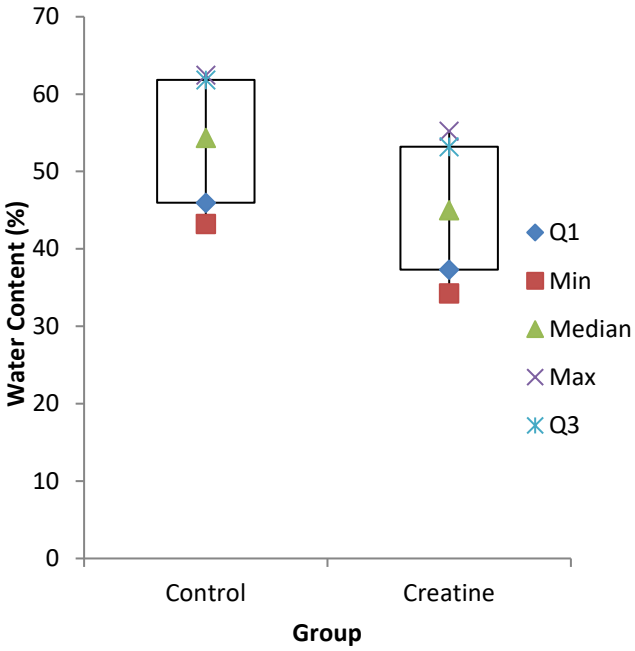

Figure 2. Box Plot. The effects of creatine (Cr) supplementation on the moisture content of the gastrocnemius muscle in mice. Plot shows water content in the Control group (CON, n = 5) was significantly greater compared to water content in the Creatine group (CR, n = 5).

DISCUSSION

The object of this designed study was to demonstrate creatine's ergogenic effect on increased weight gain, due to water concentrations. Evidence presents that oral creatine monohydrate supplementation may increase weight gain and muscle mass without an increase in water retention. On the contrary, increased weight gain and muscle mass could be due to stimulation of muscle protein synthesis. The water retention decreased and lean tissue mass increased, showing creatine monohydrate could be an ergogenic aid in running and swimming athletes. Several researcher reported that creatine induces body weight gain (Gutierrez-Sancho, 2006;Vandenberghe, 1997; Volek, 1999), others did not show any change in body mass (Balsom, 1994; Brannon, 1997). Because the moisture decreased and body mass increased with Cr supplementation, the increase in body mass could likely reflect actual muscle build. Making a point that Cr is relevant for running and swimming athletes. Haussinger et al. demonstrated that hyperhydrating a cell, which may happen during creatine supplementation, which is an anabolic signal which would positively impacts protein turnover (Rawson, 2007).

The understanding to an increased dry mass and/or stimulate to the two contractile proteins actin

and myosin heavy chain, which could shape the natural athlete is still unclear. Therefore, further research is required to understand whether this increase in body mass is a biochemical

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