dotFIT™ CreatineMonohydrate

Goal

Creatine, a natural substance found in the muscle, is now a proven safe and powerful, size and performance-enhancing dietary supplement. The goal of supplementing creatine is to increase the muscle levels of creatine and speed the regeneration of creatine phosphate beyond what can practically be accomplished by diet alone. Maximizing muscle stores of creatine through supplementation has been shown in hundreds of clinical trials to improve anaerobic performance[1,2,3,4,5,6,7,8,9,10,11,12,13,14,15], power, strength[4,11,13,14, 15,16], and enhance muscle size and/or body composition[4,7,13,16,17,18,19,20,21,22,23] when compared to placebo.

dotFIT CreatineMonohydrate is designed to match the exact compound and dosage used in successful clinical trials that have demonstrated size and performance enhancement. The dotFIT tablet form of creatine allows the user the freedom to conveniently and accurately control delivery and dosage throughout the day. Additionally because of its single ingredient, tablet form and size, dotFIT CreatineMonohydrate is ideal for increasing total creatine intake to desired levels when using other creatine products that contain mixed ingredients with limited dosage recommendations.

Rationale

Creatine (Cr) is a substance found in skeletal, cardiac, and smooth muscle. Creatine synthesis occurs in the liver, kidneys, and pancreas from the amino acids methionine, glycine, and arginine.[24] Most of the total body creatine resides in skeletal muscle where about 1/3 exists as creatine (Cr) and 2/3 as phosphocreatine (PCr). Typically, the human body manufactures about 1 g of creatine, obtains 1 g from food, and loses about 2 g/d. Therefore, under normal circumstances, creatine levels are fairly constant.[25] The average concentration of total Cr in skeletal muscle varies between 100 and 150 mmol/kg dry weight in normal humans. Cr and PCr are degraded to creatinine in a non-enzymatic, irreversible reaction. Creatinine is then filtered by the kidneys into the urine, the primary route of loss. The primary food sources of Cr are animal muscle meats.

Creatine enters a number of cell types by a sodium-dependent neurotransmitter transporter in the family, related to the taurine transporter and the members of the subfamily of GABA/betaine transporters[26,27,28] Creatine uptake appears to be enhanced by insulin[29,30] and triiodothyronine.[31] Harris found that 5g of CrM, ingested five to six times daily, increased total creatine (TCr) from a mean level of 126 mM/kg dry muscle to 148.6mM/kg, with phosphocreatine representing from 20%-40% of the increase.[32] Hultman et al later found a more gradual increase in TCr by ingesting 3g/day for 28 days. In both methods, TCr levels increased by approximately 20%.[33]

Role of Creatine in muscle

Creatine plays a pivotal role in muscle ergogenics by acting as part of an energy-buffering system.[34] When phosphorylated by the enzyme creatine phosphokinase (CK), the resulting product, PCr, can donate the inorganic phosphate to adenosine diphosphate (ADP), making adenosine triphosphate (ATP), thus supporting muscle contraction.

During periods of muscle contraction, when ATP breakdown exceeds synthesis, PCr rapidly replenishes ATP. PCr supplies the required energy to fuel ten to fifteen high-intensity contractions, such as in weight lifting. The availability of PCr in skeletal muscle has often been cited as limiting to the continuation of maximal physical effort. To be sure, the depletion of muscle PCr stores during intense exercise is associated with the onset of muscle fatigue.[35] Utilization of PCr will also contribute to the buffering of lactic acid, assisting in continuation of maximal exercise.

Creatine Supplementation and performance

The onset of fatigue during high-intensity exercise may be linked to PCr depletion, pH alterations, or lactate accumulation. Supplemental creatine may play a role in ameliorating all of these factors as shown in (Figure 8).

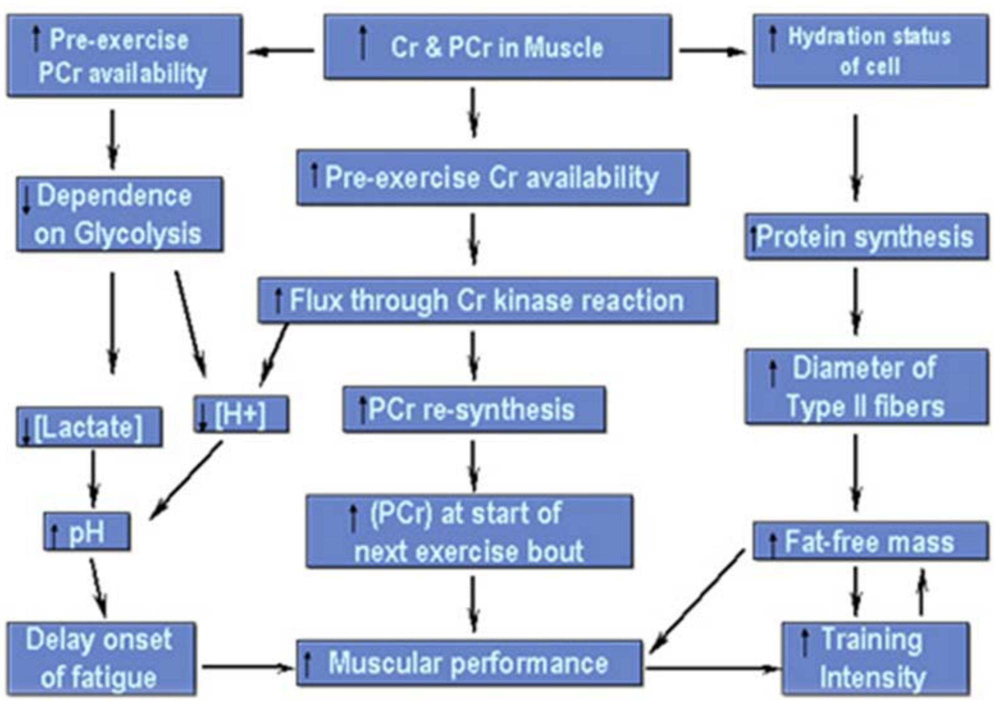

Figure 1: Impact of creatine on high-intensity exercise (adapted from Volek and Kraemer[36] with permission).

Cr phosphate, with its high-energy phosphoryl transfer potential, serves to maintain intracellular ATP levels.[37] At rest, concentrations of ATP, PCr, and Cr in skeletal muscle are 4, 25, and 13mM, respectively.[37] During exercise, levels of ATP decline very little until the stores of PCr are used.[38] Since creatine supplementation has been shown to increase intracellular levels of PCr, intracellular levels of ATP may be maintained at higher levels for a longer period of time.[39,40] Creatine ingestion has shown a reduction in plasma concentrations of hypoxanthine and lactate following exercise, suggesting lower levels of anaerobic glycolysis and another possible contribution to delaying muscular fatigue by maintaining a normal pH.[41]

The goal of creatine loading is much like the goal of carbohydrate loading by endurance athletes, but instead of increasing glycogen storage, and thus delaying glycogen depletion, loading Cr would enhance PCr levels and delay its depletion. This practice would benefit activities that are dependent on PCr as an energy source such as sprinting and weightlifting.

Creatine supplementation and hypertrophy

Creatine (Cr) supplementation is thought to contribute to hypertrophy (1) by its ability to increase high intensity muscle work capacity[3,13,16,41,42,43,44,45,46,47,48,49,50,51,52] and (2) the resultant stimulation of protein synthesis. If creatine use in healthy athletes enables them to train at a higher level for extended periods (ten to twelve weeks), this should increase protein synthesis.[53] Thus, strength and bodybuilding athletes would have better workouts and greater muscle gain (see Figure 9Figure 10Figure 11).

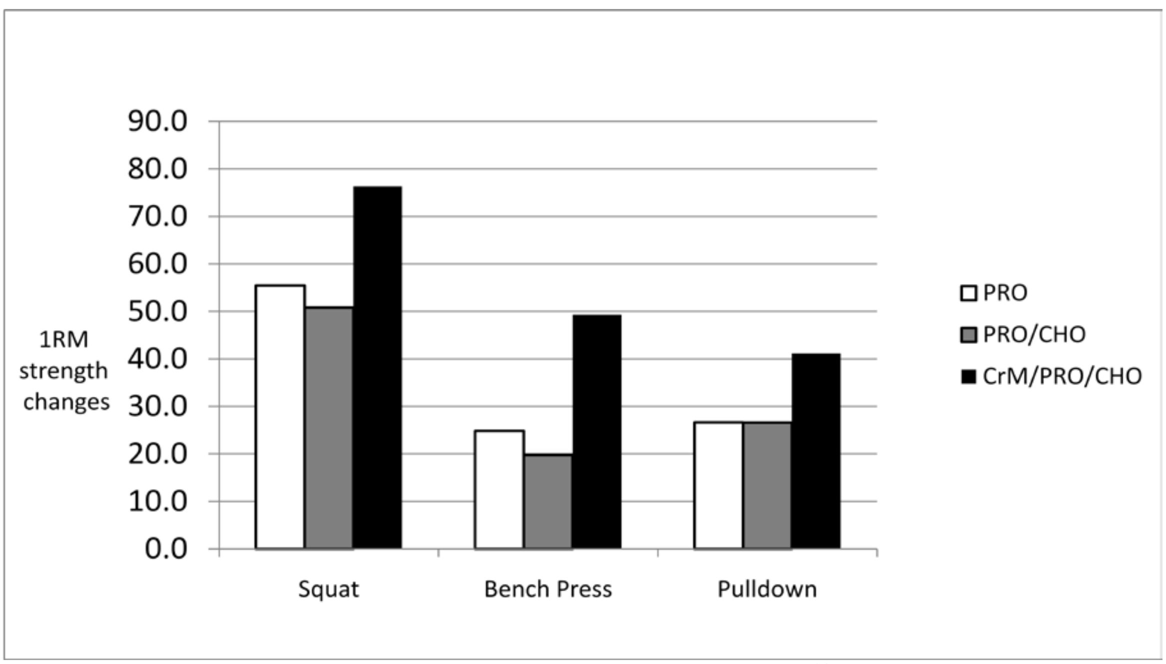

Figure 2: Clearly shows the creatine group out-performing the other groups.[63]

An increase in the synthesis of contractile protein may be responsible for this increase in diameter. As Figure 4 demonstrates, a significantly greater muscle hypertrophy response from the addition of CrM was evident at three different levels of physiology. That is, the CrM-treated group demonstrated a greater gain in LBM, hypertrophy of the type IIa and IIx fibers, and increase in contractile protein. Cr is theorized to be the chemical signal, coupling increased muscular activity to increased protein synthesis in hypertrophy.[54,55,56,57] As mentioned above, the onset of fatigue during high-intensity exercise may be linked to PCr depletion, pH alterations, or lactate accumulation , of which supplemental creatine may play a role in ameliorating, as shown in the flowchart.

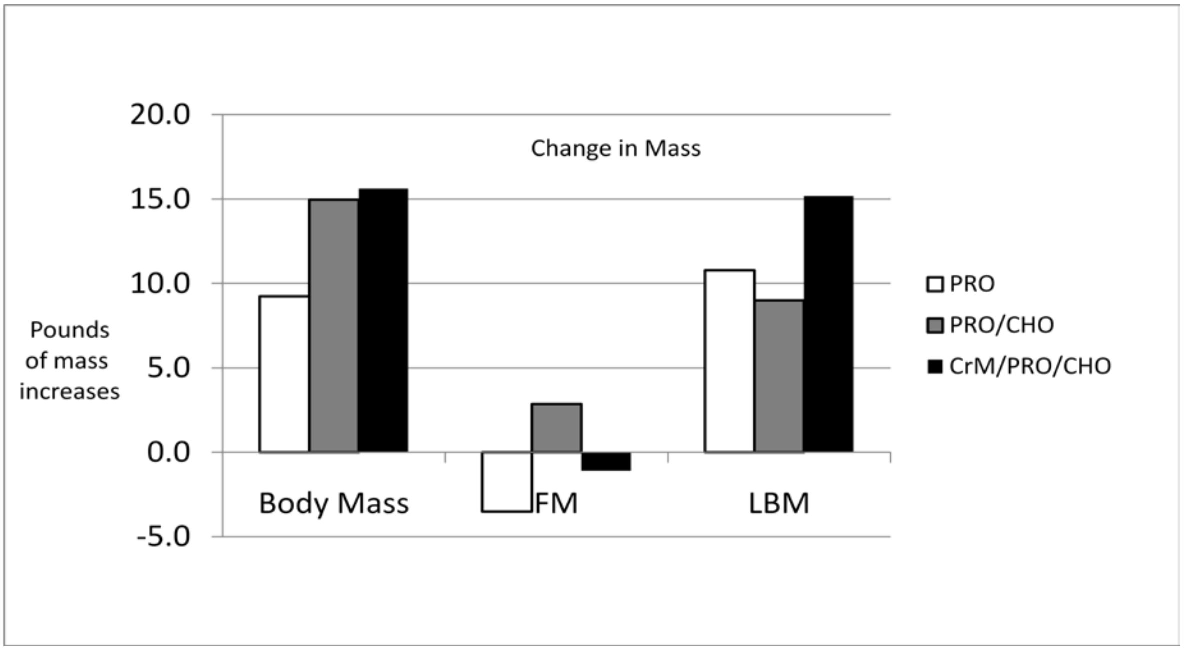

Figure 3: Shows significantly greater increases in lean body mass (LBM) in the CrM group.[63]

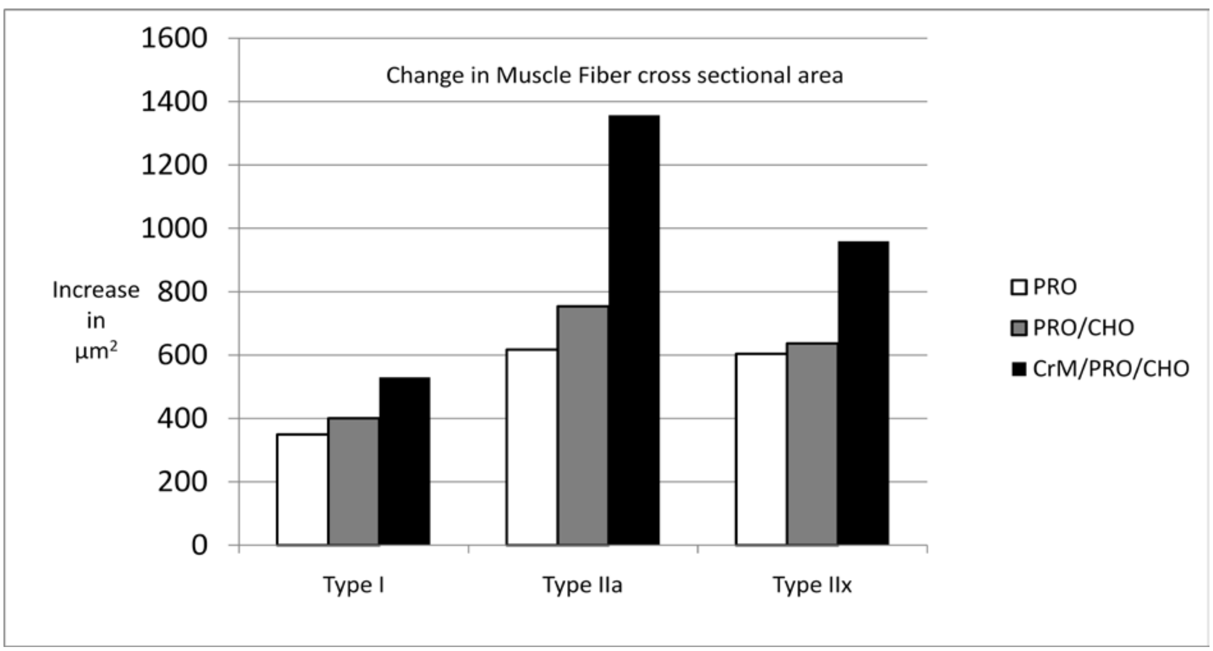

Figure 4: Demonstrates CrM significantly increased muscle hypertrophy in all three muscle fiber types when compared to the other two groups without CrM.[63]

Therefore, increasing creatine levels may not only increase work capacity, but also the signal to remodel the affected tissue. It has been suggested that Cr acts as a transcriptional or translational factor, or alters the levels of charged tRNAs or amino acid pools specific for muscle protein synthesis.[54,58]

In addition, creatine may act indirectly by increasing the hydration status of the cell. Evidence linking cellular volume and protein synthesis has been emerging.[59,60,61,62] Alterations in cell volume may affect many hormone and amino acid functions by affecting the cell membrane potential or Na+ driven substrate transport.[59,60,61] Thus, there is an inverse relationship between muscle cell fluid content and whole body nitrogen balance. Therefore, an increase in intracellular Cr from Cr supplementation may induce cell volumizing. Volumizing over a long period, a greater amount of fat-free mass (FFM) may be yielded from resistance training in healthy athletes.[22,55,56,57,58,59,60,63]

Supplement Facts (2 tablets)

Creatine Monohydrate	**2500 mg***

*Daily value has not been established.

Typical Use

- Performance enhancement for experienced anaerobic athletes unconcerned with weight gain.
- Experienced exercisers for improving muscle hypertrophy outcomes from resistance training.
- Enhancing daily functions in the elderly (confirmed by physician).[9,18,19]
- Two tablets with carbohydrate for every 30-60 pounds taken before and after workout and anytime on non-training days throughout training cycle.
- People with renal complications, consult a physician before use.
- Studies involving creatine supplementation beyond 10 weeks have shown decreases in muscle creatine stores toward baseline values.[16,22,64] This may be due to an inadequate amount of creatine during the training cycle (most studies used a maintenance dose of 5 grams a day) and/or the result of creatine transporters down-regulating. One short-term (eight to nine days) human study indicates creatine transporters do not down regulate while one long-term (12 weeks) animal study utilizing extremely high dosages in comparison to human studies had opposing results. [65]

To ensure muscle creatine stores remain elevated throughout intense training cycles and to prevent the possibility of transport down-regulation, it is recommended that 5 -10 grams be utilized for up to 10 weeks, followed by a two to four week period without supplementation. Body stores of creatine return to baseline within 4 weeks after supplementation is discontinued.[16,33] Users can repeat the cycle if appropriate. The loading strategy utilized may depend on training status and need.

Rapid Creatine Loading Strategy

- The supplementation protocol most often described in the scientific literature is referred to as the "loading" protocol. This protocol is described as ingesting approximately 5 grams of CrM four times per day for 5 – 7 days and 3–5 grams/day thereafter.[66,67]Most often used in scientific literature to increase muscle creatine stores
- Studies utilizing loading protocols of 20 to 30 grams per day for five to seven days resulted in approximately 50 percent absorption.[64,68,69]
- Performance benefits may occur more rapidly
- Maybe more beneficial for athletes in a time crunch, and need a boost in performance or strength

Gradual Creatine Loading Strategy

- It has been demonstrated that lower dosages (3 grams per day) have shown to gradually (28 days) increase creatine stores to the same extent.[64] Long-term studies using low dosages (5 to 6 grams for 10 to 12 weeks, no loading phase) resulted in significant increases in strength and muscle size when combined with resistance training.[21,70]
- The effect is more gradual, therefore performance benefits do not occur as quickly
- Athletes following a specific training cycle (e.g. muscle hypertrophy) and not in a time crunch can utilize this protocol
- Users can start slowly to maximize absorption and to let their connective tissue and muscle repair keep up with strength increases to avoid injury.
- Ultimately a user’s terminal/maintenance dose will depend on goal and personal preference. Creatine loading is personal and varies based on a user’s physiological state. A minimum of 5gms daily may maintain desired levels for many users and up to 15gms/daily is not uncommon for larger individuals. During non-training days, the amounts should continue to be split throughout the day.
- Approximately 25 to 45 g of carbohydrate (depending on size) should be ingested with each dosage to maximize creatine storage.[71,72,73]

Precautions

Creatine Supplementation in Children and Teens

Pediatricians have stated that creatine supplementation is not safe for children and adolescents.[74] While there is a shortage of investigations that have been conducted using young subjects, no study has shown creatine monohydrate to have adverse effects in children. In fact, long-term CrM supplementation (e.g., 4 – 8 grams/day for up to 3 years) has been used as an adjunctive therapy for a number of creatine synthesis deficiencies and neuromuscular disorders in children.[75,76,] Considering the lack of available data on youth sports performance and CrM supplementation dotFIT® does not recommend that children under the age of 18 use creatine monohydrate. Young athletes must learn that creatine is not a magic potion or short cut to athletic success and that proper training and dietary strategies to optimize performance must be accomplished first.[77]

Contraindications

Due to one study performed on rats and two human case reports, creatine supplementation is contraindicated for those with kidney problems or at risk for kidney disease because of possible increased kidney stress.[78] However, clinical trials involving creatine supplementation in healthy adults have found serum creatine and creatinine levels (indicators of renal dysfunction) within normal ranges.[78] Creatine supplementation should be avoided by pregnant or lactating women because of the lack of studies done with this population. Athletes not desiring weight gain should avoid creatine supplementation or attempt to lose body fat simultaneously in order to off-set muscle weight increases thus still receiving creatine's potential performance benefits

Adverse Reactions

Despite the amount of creatine ingested (i.e. up to 30 grams/day for 5 years) in clinical research, no adverse reactions (e.g. cramping or increases in core body temperature) have been documented.[6,8,40,79,80,81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,97]

Upper Limit/Toxicity

The upper limit for creatine monohydrate has not been established.[78]

Summary

Purpose

- Performance enhancement for experienced anaerobic athletes unconcerned with potential weight gain
  - Especially those with a poor intake (low or no meat intake) or low biosynthesis
- Experienced exercisers for improving muscle hypertrophy outcomes from resistance training
  - Especially those with a poor intake (low or no meat intake) or low biosynthesis
- Enhancing daily functions in the elderly (confirmed by physician).
- When using other multi ingredient formulas that contain creatine, it can be a convenient way to increase total daily creatine without increasing intake of the other ingredients

Unique Features

- Contains pure creatine-monohydrate, the form shown in over 500 studies to yield results
- Convenient tablet delivery (no mess, consistent dose, no stomach upset)
- Manufactured in a FDA-registered facility, in compliance with Good Manufacturing Practices (GMPs) exclusively for dotFIT™

dotFIT CreatineMonohydrate

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