The Longwood Herbal Task Force

(http://www.mcp.edu/herbal/default.htm) and

The Center for Holistic Pediatric Education and Research

(http://childrenshospital.org/holistic/)

Clinician Information Summary

CREATINE

SUMMARY

Creatine is promoted as a natural way to enhance athletic performance and build lean body mass. It is also used to treat rare metabolic and neuromuscular metabolic disorders and chronic heart failure. Endogenous creatine is synthesized primarily in the kidney and liver, and transported by the blood for use in the muscles. It is metabolized and excreted renally. Creatine supplementation appears to have modest benefits for intense, repetitive exercise lasting less than 30 seconds. It has no significant benefits for prolonged (endurance) aerobic exercise. Additional studies are needed to clarify creatine's role in treating metabolic and neuromuscular disorders and chronic heart failure, although its use in case series appears promising. Creatine and creatine analogs are under investigation in animal studies of cancer treatment. It is very safe, although there is a report of renal failure in a patient taking high doses over a prolonged period and a similar report in a patient with pre-existing renal disease. Caffeine may counteract creatine's benefits on acute intermittent exercise performance. There are no data evaluating the safety of creatine supplements during pregnancy, lactation or childhood.

POPULAR USES: Enhancement of athletic performance, treatment of rare metabolic and neuromuscular disorders and chronic heart failure

CHEMICAL CONSTITUENTS: Creatine

SCIENTIFIC DATA

In vitro: Dystrophic skeletal muscle cells from mice and Duchenne muscular dystrophy patients that were treated with creatine exhibited increased intracellular phosphocreatine and

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increased myotubular formation and survival. Cyclocreatine, a creatine kinase substrate analog, is cytotoxic to a broad spectrum of animal and human solid tumor cell lines.

In animals: Rats given creatine supplements had no change in glycogen resynthesis in liver or skeletal muscle; chronic supplementation resulted in down regulation in the expression of creatine transporter protein which is responsible for creatine uptake into cells. There are no animal studies evaluating creatine's effects on cardiac or skeletal muscle function. Oral administration of creatine to G93A transgenic mice (who have significant mitochondrial dysfunction leading to symptoms similar to amyotrophic lateral sclerosis, ALS) led to dose-dependent improvement in motor performance and extended survival. In mice and rats, creatine and its analogs significantly slowed solid tumor growth.

In humans: Creatine supplementation raises muscle levels of phosphocreatine and increases lean body mass. Creatine supplementation enhances weight training performance and brief sprinting performance, but it has no significant impact on endurance exercise. Both case series and randomized trials support the use of creatine supplementation in patients with heart failure. In two pilot studies of patients with a variety of neuromuscular diseases, creatine supplementation increased all measured indices of high-intensity strength; in a randomized, cross-over study of seven patients with mitochondrial cytopathy, creatine supplements resulted in significantly increased handgrip strength, but no changes in lower intensity aerobic activities. Several children with hepatic guanidinoacetate methyltransferase (GAMT) deficiency or hyperornithinemia have been treated with creatine supplementation with significant biochemical and/or clinical improvement.

TOXICITY AND SIDE EFFECTS

Side effects: Allergic reactions have been reported. Patients with pre-existing renal disease have developed worse renal function while taking creatine; renal function returned to normal after stopping creatine supplementation. Other side effects include weight gain of 1-2 kg during the five day loading period, gastroenteritis from undissolved creatine powder, diarrhea, heat intolerance and muscle cramps. Most studies have been less than 12 weeks long; little is

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known about the effects of chronic use.

Interactions with other medications: Creatine is contraindicated for patients taking diuretic medications. Cimetidine competes with creatinine for renal tubular secretion and may increase the risk of adverse renal effects; similar interactions may be found with probenecid which blocks renal tubular transport. Because non-steroidal anti-inflammatory drugs (NSAIDs) may impair renal function, patients using these medications should be cautious in taking creatine supplements. Caffeine apparently antagonizes creatine's ergogenic effects, leading to a complete loss of creatine's benefits on intense intermittent exercise performance.

Contraindications: Creatine is contraindicated for patients with impaired renal function or dehydration.

Pregnancy and lactation: No clinical studies

Pediatric use: No clinical studies or systematic surveillance

ADDITIONAL RESOURCES

HOME: http://www.mcp.edu/herbal/default.htm

Creatine Complete Monograph:

http://www.mcp.edu/herbal/creatine/creatine.pdf

Creatine Patient Fact Sheet:

http://www.mcp.edu/herbal/creatine/creatine.ph.pdf