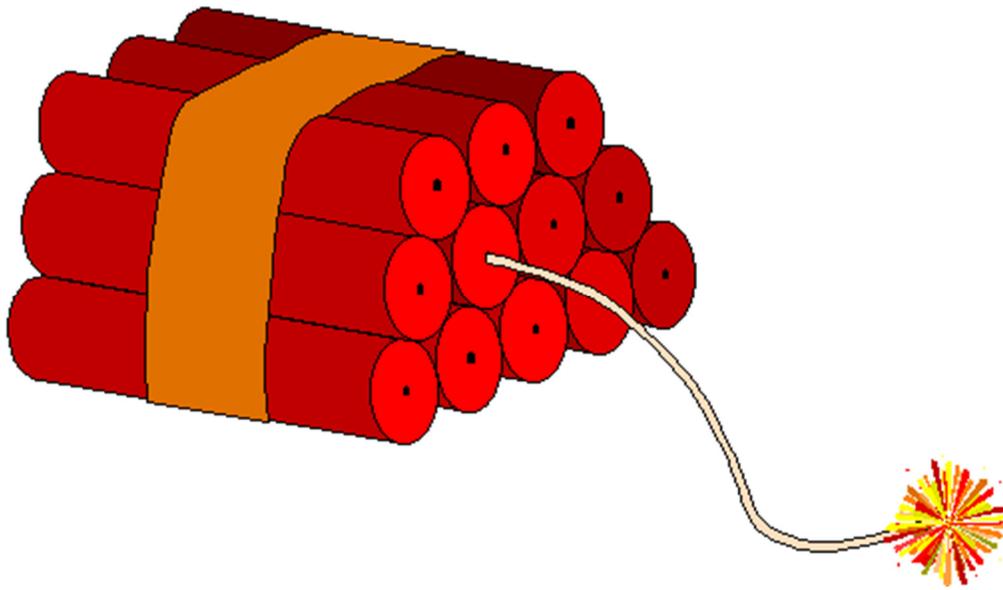


Wrestling Practices and Creatine Monohydrate: A **Deadly** Combination?



An investigative report by Katherine Dudash

14 FEB 2000

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Introduction

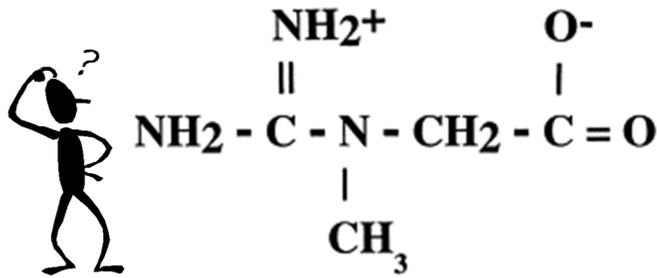
On December 9th, 1997 Michigan University wrestler, Jeff Reese, attempted to cut 12 lbs in one day. His goal was to wrestle at the 150 lb weight class for the Wolverines in the team's match against Michigan State. Reese died trying to reach his goal.

Cutting weight is a common practice in the sport of wrestling. In fact, wrestlers have been shedding pounds to qualify for lower weight classes since the NCAA made wrestling a sport in 1928. Prior to any match, disciplined wrestlers will subject themselves to grueling workouts in rubber suits and overheated rooms. The wrestlers try to sweat the weight off, risking severe dehydration all for the sake of winning. Unfortunately, 21-year-old Jeff Reese, and two other wrestlers, died before he reached the wrestling mat. Doctors reported that Reese died from a heart malfunction and kidney failure (Younge, 1998).

In a news report by The Minnesota Daily, Dr. David Wang said, "the deaths most likely were a result of the weight-cutting process" (Younge, 1998). Assistant Coach for the Gophers, Marty Morgan, defends the medically unpopular methods for cutting weight saying, "the medical world wants this [the deaths] to be wrestling related, and the way we cut weight, because for years they've wanted to ban this, and outlaw it and change it" (Younge, 1998). Although many plead for research and scientific data on the matter, Dr. Wang believes the medically community will not be the one to furnish the information (Younge, 1998). The human subjects committee would never allow such dangerous practices, such as exercising in a sauna with a rubber suit on, to be implemented for scientific study (Younge, 1998). So the inhumane, self-deprivation practices continue to go unstudied.

In the same report by The Minnesota Daily, Younge (1998) notes that for 70 years of wrestling history not a single death was recorded as a result of shedding weight, at least until the end of 1997. The sudden deaths of three wrestlers calls into question if something else is causing the deaths. Dr. Wang suspects creatine supplementation might be the culprit. Research studies have shown that the dietary supplement does improve power and strength, apparently with no known side effects. Creatine helps the muscles to retain water. For wrestlers using the supplement, "creatine works as an opposing force" when the wrestler tries to shed weight, causing problems in the body's cooling system (Younge, 1998). Although no direct connections have been made, Jeff Reese was reported as using creatine when he died trying to make weight (Younge, 1998). My investigative report is aimed at uncovering the potential dangers of combining creatine supplementation with the excessive weight loss practices used by competitive wrestlers.

For Younge's full report, titled "Weighing In," go to: <http://www.mndaily.com/daily/1998/02/09/news/> then scroll down and click on the article.



How does Creatine Work?

In recent years, oral supplements of creatine monohydrate have become "increasingly popular among different athletes for use as a natural ergogenic aid (Stout et al., 1999). A surge in the use of creatine began in 1992, when "Harris et al showed that oral supplementation with high doses of creatine resulted in a 20% increase in skeletal muscle creatine concentration" (Juhn, 1999). As advertised by Nutrisoy, "creatine is a protein found in the body, concentrated in the skeletal muscles, and critical to the production of energy in the ATP cycle" ("Creatine Monohydrate," 2000). ATP (adenosine triphosphate) is broken down to ADP (adenosine diphosphate) by the creatine kinase enzyme resulting in a release of energy and a decrease in the creatine phosphate molecule. By replacing the creatine phosphate molecule through creatine supplementation, more ATP becomes resynthesized and available for breakdown into energy. The following is a diagram of the ATP cycle taken from a creatine monohydrate advertisement, which can be viewed from the following link: <http://www.nutrisoy.com/creatine.html>.

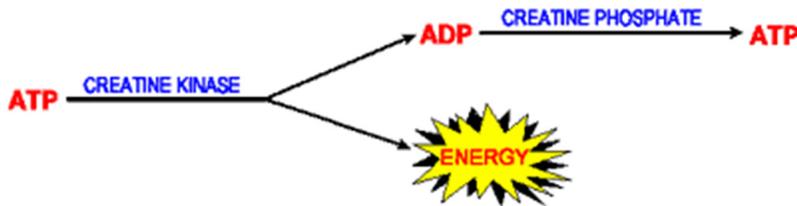


Figure 1: ATP (adenosine triphosphate) Cycle

The creatine compound, or methyl guanidine-acetic acid, naturally appears in the bodies of non-vegetarians. Creatine appears in heart muscle tissue, smooth muscle tissue, skeletal muscle tissue, sperm, and in the neural tissue of the brain, eye, and nerves (Clark, 1998). The total amount of creatine compound is primarily stored in skeletal muscles (approximately 95%) and exists in both free and phosphorylated forms (Jacobs, 1999; Kreider, 1997). For muscles to sustain a high-energy output, the ratio of adenosine triphosphate to adenosine diphosphate must remain high (Greenhaff, 1997). Muscle fatigue develops when the skeletal muscles are unable to maintain this ration, due partly to phosphocreatine depletion (Greenhaff, 1997). Creatine supplementation helps increase phosphocreatine concentrations, which maintain adenosine triphosphate resynthesis during exercise (Greenhaff, 1997).

In order to boost total muscle creatine concentrations, consumers are encouraged to ingest approximately 20g of creatine supplements per day for the first six days (Greenhaff, 1997). After the initial loading period, consumers may reduce intake to approximately 2g of creatine per day to maintain total muscle creatine concentrations (Greenhaff, 1997). A study conducted by Green et al (1996) recommends that creatine uptake into muscles was

enhanced when creatine supplementation was combined with a high carbohydrate diet. In the shared pursuit of increasing creatine concentrations in skeletal muscles, Greenhaff's study (1997) notes that as total muscle creatine concentrations increase, "urinary creatine excretion and plasma creatine concentration are reduced." This observation suggests that creatine supplementation causes creatine to be trapped in the skeletal muscles and prevents the body from excreting creatine through the process of urination. Creatinine is the end product of creatine breakdown and is eliminated from the body through urination (Greenhaff, 1997). As one might suspect, increases in creatine supplementation do lead to increases in creatinine (Greenhaff, 1997). Greenhaff (1997) reports that creatinine excretion is often used as an indicator of kidney function. Is it possible for kidney failure to go undetected if someone taking creatine supplements is given a urinalysis?

Wrestlers sometimes must submit to urinalysis before competitions to check for dehydration and kidney failure. Assuming that the wrestler is not using trickery, could the use of creatine supplements disguise kidney failure? The aforementioned wrestler, Jeff Reese, died from heart and kidney failure, when he was trying to cut weight. His parents and coaches report that he was taking creatine at the time. Is creatine linked to the tragic death of this young athlete? Certainly, this is food for thought.

The findings from the Greenhaff study (1997) on creatine concentrations and creatinine excretions are contradicted by a report by Poortmans, et al (1997). Both studies subjected participants to similar creatine loading and maintenance regimens. That is, 20g of creatine per day during the loading period and 2g of creatine per day after the loading period. Poortmans et al (1997) report "arterial and urine creatinine values were not affected by the creatine ingestion." Meanwhile the arterial and urine concentrations of creatine increased (Poortmans et al, 1997). The Poortmans et al study (1997) concludes, "short-term oral creatine supplementation does not appear to have any detrimental effect on the renal responses of healthy men." People should be concerned with the possible effects of creatine supplementation, especially when such opposing and contradictory evidence appears in scientific research. Those people using creatine should do so with the utmost caution.



The Possible Benefits of Creatine Loading

Creatine is alleged to be an effective nutritional ergogenic aid to enhance sport or exercise performance and recovery (Branch & Williams, 1998; Kreider, 1997). The aforementioned creatine advertisement at Nutrisoy.com (2000) proclaims, "creatine significantly increases strength, speed, and energy." Although a few studies contradict this claim, most research studies investigating the effects of creatine supplementation affirm creatine's potential for enhancing exercise performance. For example, creatine's link with enhanced performance in high-intensity, short-term exercise tasks is reported among several studies (Branch & Williams, 1998; Dalton et al., 1998; Volek et al., 1997). More specifically, Volek et al. (1997) stated, "athletes participating in a resistance training program may benefit from creatine monohydrate supplementation because the supplementation allows them to complete their workout at a higher intensity." Another study suggests creatine monohydrate helps to counteract "the rapid depletion of muscle phosphocreatine thought to be a limiting factor when performing maximal anaerobic work" (Stout et al., 1999). On the other hand, the investigative efforts of Branch & Williams (1998) also report creatine supplementation has not consistently shown enhanced performance in exercise tasks dependent on anaerobic or aerobic glycolysis. Perhaps these variations in research findings reflect individual differences in creatine supplementation.

Bosco et al. (1997) did a study to investigate "the effect of creatine monohydrate ingestion on performance in 45 seconds of maximal continuous jumping and in an all-out treadmill run." Creatine significantly enhanced performance in the jumping and running exercises, but performance seemed to plateau whenever the contribution of anaerobic metabolism was decreasing (Bosco et al., 1997). Perhaps creatine is beneficial in anaerobic exercise and not beneficial in aerobic exercise as suggested in the observed performance effects reviewed in the Kreider study (1997) and in a review by Plavin (1998). More specifically, Juhn (1999) notes "oral creatine supplementation is potentially ergogenic only for activity that has a high anaerobic component, not for endurance activity." Or as the study by Stout et al. (1999) suggests, "discrepancies in the literature regarding the effects of creatine monohydrate supplementation on performance may be attributed to the highly variable inter-individual response in muscle creatine retention from creatine monohydrate loading." Other factors contributing to discrepancies between research studies include the use of small sample sizes, low-dose supplementation regimens, prolonged recovery periods between exercises, high-intensity endurance exercises, and submaximal aerobic exercises (Kreider, 1997). Obviously, more studies need to be conducted in order to clarify this matter.

Creatine has also been shown to increase body mass. A study by Volek et al. (1997) indicated a significant increase in body mass (average increase = 1.4 kg) after creatine ingestion. However, the initial increase is most likely due to water retention rather than an increase in lean muscle mass (Branch & Williams, 1998). A report by Kreider (1997) supports that the theory of an increase in body weight is due to creatine stimulated water retention. Kreider (1997) adds, "creatine may stimulate an initial gain in intracellular fluid serving to increase cellular osmotic pressure and stimulate protein synthesis. These findings suggest that long-term creatine supplementation may enhance lean tissue accretion."

Finally, an 8-week study conducted by Stout et al (1999) reports increases in fat-free body weight and enhanced performance in bench press strength, vertical jump, and 100 yd sprint exercises for those participants ingesting creatine monohydrate. The study also indicated that all variables improved when creatine monohydrate was combined with the same carbohydrate placebo used in the control group (Stout et al., 1999). This result suggests creatine combined with carbohydrates increases creatine uptake thus improving performance (Kreider, 1997). Unfortunately, wrestlers rarely maintain a well-balanced diet during their training and competitive seasons.



Is Creatine Supplementation Safe?

The advertisers at Nutrisoy.com claim "creatine has been used safely for years" ("Creatine Monohydrate," 2000). In fact, the only scientifically documented and published side effect of creatine supplementation is weight gain (Kreider, 1997). Some research studies would not back the claim that creatine is completely safe. Within the past couple of years, some physicians, athletic trainers, and dieticians have raised concerns about using creatine. Anecdotal reports are linking creatine with renal dysfunction, gastrointestinal disturbances, and liver damage (Juhn, 1999; Kreider, 1997). Some subjects have complained of muscle cramping when exercising in the heat after ingesting creatine supplements (Kreider, 1997). This concern is especially relevant to wrestler's trying to cut weight. Findings by Clark (1998) and Juhn (1999) suggest warning those taking creatine supplements to stay properly hydrated and to avoid strenuous exercise especially during the loading period. As during the loading period, many subjects experience water retention from the cells taking on extra water as the creatine passes into the muscle cells (Clark, 1998). The water retention would potential interfere with the body's cooling mechanism. The Clark study (1998) indicates, "there are several unpublished anecdotal reports of oral creatine supplementation being associated with muscle cramps, heat intolerance, muscle strains, and diarrhea." These side effects, when combined with the wrestling customs of cutting weight, water weight, make a deadly combination. That is, as the wrestler works to sweat off water weight, the creatine holds on to the water in the skeletal muscle cells, preventing sweating. Unable to cool itself, body temperature may rise to dangerous levels.

Those individuals interested in creatine supplements should be warned of the possible dangers and concerns linked with this supplement. Granted, more research needs to be done to confirm the anecdotal reports of muscle cramping, renal stress, GI disturbances, and liver damage. Short-term and long-term effects of creatine supplementation have yet to be determined by medical studies. In addition, creatine consumers should keep in mind that the Food and Drug Administration has not approved the supplements. In fact, "the FDA has officially logged 32 complaints regarding people who used creatine; these complaints include seizure, cardiac arrhythmia, cardiomyopathy, deep venous thrombosis, rhabdomyolysis, and death" (Juhn, 1999).



VS.



Should Wrestlers take Creatine?

Some people believe the use of creatine is unethical because it is a type of blood doping, undetectable with current drug testing (Plavin, 1998). For this reason, some people believe creatine should not be used by any competitive or professional athlete. Others tend to disagree with this opposing viewpoint, creatine advocates claim that creatine supplementation is not a form of blood doping (Branch & Williams, 1998). Moreover, the drug is still legal in the United States; although still unapproved by the Food and Drug Administration.

Winning at all costs seems to be at the heart of the wrestler's mentality. Wrestlers live by their intensive training, but lately some wrestlers have been dying. "Many coaches and athletes agree it is time to expose the sports' subculture and eliminate the pressure -- and danger -- of drastically cutting weight" (Quick, 1997). Granted, steps have been taken to prevent severe cases of dehydration, but the complications associated with creatine supplementation and the rigors of wrestling remain unknown. Coaches and athletes need to self-educate on the potential dangers of extreme training regimens and using non-FDA approved supplements, in order to avoid repeating the tragic situations, such as Jeff Reese's untimely and premature death. Although no hard evidence exists between Reese's death and creatine supplementation, please remember that sometimes what you do not know, can kill you.



References

Bosco, C., Colli, R., Foti, C., Gabossy, A., Kovacs, I., Pucspk, J., Pulvirenti, G., Tihanyi, J., Tranquilli, C., Viru, A., & Viru, M. (1997). Effect of oral creatine supplementation on jumping and running performance. International Journal of Sports Medicine, 18, 369-372.

Branch, J. D., & Williams, M. H. (1998). Creatine supplementation and exercise performance: An update. Journal of the American College of Nutrition, 17, 216-234.

Clark, J. F. (1998). Creatine: A review of its nutritional applications in sport. Nutrition, 14, 322-324.

Creatine monohydrate. [Online]. Available: <http://www.nutrisoy.com/creatine.html>.

Dalton, B., McNaughton, L. R., & Tarr, J. (1998). The effects of creatine supplementation on high-intensity exercise in elite performers. European Journal of Applied Physiology and Occupational Physiology, 78, 236-240.

Green, A. L., Hultman, E., MacDonald, I. A., Sewell, D. A., & Greenhaff, P. L. (1996). Carbohydrate ingestion augments skeletal muscle creatine accumulation during creatine supplementation in man. American Journal of Physiology, 271, 821.

Greenhaff, P. L. (1997). The nutritional biochemistry of creatine. Nutritional Biochemistry, 8, 610-618.

Jacobs, I. (1999). Dietary creatine monohydrate supplementation. Canadian Journal of Applied Physiology, 24, 503-514.

Juhn, M. S. (1999). Oral creatine supplementation: Separating fact from hype. The Physician and Sports Medicine, 27, [Online].

Available: http://www.physsportsmed.com/issues/1999/05_99/juhn.htm.

Kreider, R. B. (1997). Creatine supplementation: Analysis of ergogenic value, medical safety, and concerns. Journal of Exercise Physiology. [Online].

Available: <http://www.afpafitness.com/creatine4.htm>.

Plavin, J. (1998). Safety and efficacy of creatine supplementation as an ergogenic aid: The jury is still out. [Online]. Available: [wysiwyg://29/http://www.ped.med.umich.edu/ebm/creatine.htm](http://www.ped.med.umich.edu/ebm/creatine.htm).

Poortsmans, J. R., Auquier, H., Renaut, V., Durussel, A., Saugy, M., & Brisson, G. R. (1997). Effect of short-term creatine supplementation on renal responses in men. European Journal of Applied Physiology and Occupational Physiology, 76, 566-567.

Quick, J. (1997). Deaths force change in wrestling. Oregon Live: Sports: Local and National, [Online]. Available: <http://oregonlive.com/sports/spst/9801/spst01162.html>.

Stout, J., Eckerson, J., Noonan, M. S., Moore, G., & Cullen, D. (1999). Effects of 8 weeks of creatine supplementation on exercise performance and fat-free weight in football players during training. Nutrition Research, 19, 217-225.

Volek, J. S., Kraemer, W. J., Bush, J. A., Boetes, M., Incledon, T., Clark K. L., & Lynch J. M. (1997). Creatine supplementation enhances muscular performance during high-intensity resistance exercise. Journal of the American Dietetic Association, 97, 765-770.

Younge, A. (1998). Weighing in. The Minnesota Daily [Online]. Available: <http://www.mndaily.com/daily/1998/02/09/news/>.