Creatine became a popular supplement after the 1992 Olympics in Barcelona. Gold medal winners Linford Christie in the men’s 100m and Sally Gunnell in the women’s 400m hurdles supposedly used creatine supplements. By the Olympic Games in 1996 in Atlanta, approximately 80% of all athletes used creatine. This section discusses the efficacy of creatine in different sports and the supposed mechanisms of action.

Creatine in the Body:
Creatine, an amino acid, is a protein compound that is produced naturally in the liver and present mostly in muscle tissue. It is not an essential nutrient, because it can be synthesized within the human body. In normal, healthy individuals, diet and oral ingestion together provide approximately 2 grams of creatine / day. At the same time and at approximately the same rate (2 g/ day) creatine is broken down to creatinine and excreted in the urine. Creatine phosphate is the result of creatine combining with phosphate, and is utilized to store energy for use in muscle contraction. This protein compound is found in many foods we eat, such as red meat. Biltong and herring have the highest creatine content of all natural foodstuffs.

The primary dietary sources of creatine are:

<table>
<thead>
<tr>
<th>Food Type</th>
<th>Creatine Content (g/100mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FISH</td>
<td></td>
</tr>
<tr>
<td>Shrimp</td>
<td>Trace</td>
</tr>
<tr>
<td>Cod</td>
<td>0.3</td>
</tr>
<tr>
<td>Herring</td>
<td>0.65-0.1</td>
</tr>
<tr>
<td>Salmon</td>
<td>0.45</td>
</tr>
<tr>
<td>Tuna</td>
<td>0.4</td>
</tr>
<tr>
<td>MEAT</td>
<td></td>
</tr>
<tr>
<td>Beef</td>
<td>0.45</td>
</tr>
<tr>
<td>Pork</td>
<td>0.4</td>
</tr>
<tr>
<td>OTHER</td>
<td></td>
</tr>
<tr>
<td>Milk</td>
<td>0.01</td>
</tr>
<tr>
<td>Cranberries</td>
<td>0.002</td>
</tr>
</tbody>
</table>

How does it work?
Creatine acts mainly as a phosphate replacement tool in the burning of ATP (energy). As ATP is burnt, it loses a phosphate and becomes ADP. This form of ‘energy’ cannot be utilized by the body, until creatine phosphate lends its phosphate to switch it back to ATP, which can then be used again by the muscle for fuel.

The creatine phosphate replacement system is the most significant source of muscle fuel during sessions of high muscle activity, such as sprints, or up to 10 seconds of high intensity exercise. Increased creatine stores may also stimulate the rate of the body’s resynthesis of its own creatine supply.
Studies of Creatine Supplementation:

Harris et al. (1992) were the first to state that the ingestion of creatine monohydrate could increase total-muscle creatine stores (creatine & phosphocreatine). In that study, ingesting 5g of creatine 4 – 6 times a day for several days increased the total creatine concentration by an average of 25 mmol/kg dry weight, and 30% of the increase in total creatine content was in the form of phosphocreatine. The authors suggested that these increases could improve exercise performance but did not test this suggestion in their study.

The 1st performance study was conducted by Greenhaff et al. (1993). Subjects ingested 20g of creatine monohydrate for 5 days, and creatine indeed improved performance by about 6% during repeated bouts of maximal knee extensor exercise.

Creatine Loading Regimens: RAPID LOADING PROTOCOL

Most studies used a creatine loading regimen of 20g / day in 4 portions of 5g each given at different times of the day (i.e. with meals / snacks of about 50-100g carbohydrates) for a 5-6 day period. This regimen has been shown to increase the muscle creatine concentration, on average by about 25 mmol/kg dry weight. Hultman et al. (1996) found that after an initial loading phase of 20g / day for 6 days, a subsequent dose of 2 g/day was enough to maintain the high total-creatine concentration for 35 days, whereas stopping creatine supplementation after 6 days caused a slow gradual decline of the creatine concentration in muscle.

This loading scheme is generally accompanied by increases in body weight of 0.5 – 3.5 kg per week. The average increase in body mass is about 1 kg.

Theoretically, this increase in body mass and possible change in body composition results from increases in intracellular water, stimulation of protein synthesis, or a decrease in protein breakdown.

Because the decrease in urine production exactly paralleled the time course of the increase in muscle creatine concentration, creatine likely causes water retention in skeletal muscle cells because of an increase of the intracellular osmolarity of the muscle fibers. Evidence suggests that some of the weight gain may be attributable to the anabolic effect of creatine (muscle building effect), although in short term (5 days) this effect is not likely to be an important factor. The increase in body mass may be beneficial or have no effect in some disciplines. However, in sports that involve weight – bearing activities, such as running or gymnastics, the weight gain caused by creatine supplementation could have a negative impact on performance.
SIDE EFFECTS OF THE RAPID LOADING PROTOCOL:

- Stress on liver and kidneys
- Muscle tears
- Muscle cramps
- Tendon tears
- Muscle injuries
- Delayed rehabilitation from injuries
- Dehydration
- Gastrointestinal problems
- Weight gain
- Cells become bloated with water – ‘creatine bloat’

Creatine Loading Regimens: SLOW LOADING PROTOCOL:

With the slow loading protocol, the type of creatine also changes. As with the rapid loading phase, creatine monohydrate was used, with the slow loading protocol, creatine ethyl ester (CEE).

What is CEE? Creatine Ethyl Ester is creatine monohydrate with an ester attached. Esters are organic compounds that are formed by esterification. Regular creatine monohydrate has been shown effective at increasing lean muscle mass, muscle strength and athletic performance. However, regular creatine monohydrate is absorbed poorly by the body – and its effectiveness is dependant upon the cells ability to absorb it. The poor absorption rate of creatine monohydrate requires the creatine user to ingest large dosages of creatine to achieve the desired effect. Long-term clinical studies have proven that creatine monohydrate is safe for use with persons free of medical complications, but why would you want to ingest more creatine monohydrate than you have to simply because your creatine is inefficient?

3 grams / day consumed with a substantial carbohydrate meal or snack. Maintenance dose is also 3 grams / day. This means that you can safely take CEE on a regular basis of 3 grams per day and most of the side effects associated with creatine monohydrate will not be present.

Even though there are fewer side effects associated with CEE, creatine still needs to be taken very specific and must be accompanied by very high intensity training to show any effects (read later on).
1. Why would I consider using Creatine?

- Creatine may help in increasing lean body mass during resistance training programs (i.e. strength).
- It may also assist the body in regenerating its own creatine stores after long sessions of intense physical activity.

2. What can Creatine do for me?

- It has been shown that creatine supplementation can enhance performance during exercises, which include repeated sprints and/or sessions of highly intensive physical activity.
- Creatine loading results in weight gain induced by fluid retention, which is a by-product of the rapid loading process.
- If you are a developed athlete taking part in a resistance training program, creatine may help to augment lean body mass.

3. What can Creatine not do?

- Creatine CANNOT build muscle in conjunction with light exercise training programs.
- This supplement will only be efficient in a program which involves 4 – 6 intensive training sessions per week, or short sessions of intense exercise split by rest periods of under a minute (i.e. anaerobic training).

4. Are there any other side effects which I should be aware of?

- Studies have shown that creatine loading may be associated with increased muscle cramping as well as an excess of lactic acid!
- Over-supplementation may result in damage to the liver or kidneys, though no study has been conclusive in this regard.
- Extended or excessive supplementation of creatine has no added benefits, but is a practice often reported by athletes using it.

5. Who can benefit from using Creatine?

- “Creatine will have best results in fit and highly active persons, and may increase their lean body mass by up to 1% in total, but will have little to no effect on the average person who is not involved in intensive sporting activities”, says Prof Tim Noakes form the UCT Sport Science Institute.
- Creatine can also be taken in to aid in the recovery of muscle injuries such as muscle tears or stretches. Creatine has been shown to aid in the recovery of damaged muscle tissue.
6. Who should consider using it?

- Creatine can benefit developed athletes who are following resistance training programs.
- It is best used by athletes who want to increase their lean body mass or who want to aid the repair of damaged muscle tissue.
- Creatine may be used successfully by participants in sports involving irregular activity patterns (e.g. rugby, soccer, basketball, racket sports).

7. Who should not use Creatine?

- Teen athletes should not use creatine, according to Sports Scientist Dr. Lourens Erasmus. Creatine may increase the muscle mass, but with a bone structure not strong enough to accommodate this increased muscle mass, joints and bones may be damaged.
- A person with kidney problems should not use creatine, since this protein compound will increase the workload of the kidneys. “There has not been enough research done with creatine. There is anecdotal evidence suggesting it causes renal problems amongst younger users”, according to Shelly Meltzer, a dietician with the Sport Science Institute.
- Other anecdotes report muscle strains or pulls, and muscle cramps especially if athletes train in the heat, as well problems with water retention. More research needs to be done.

8. Is Creatine legal?

- Yes creatine is legal.

9. What is the verdict on Creatine?

- Contrary to popular belief, creatine is not the answer to getting a chiseled body.
- In fact, creatine will have little or no effect on the average person, even if that person goes to the gym regularly.
- Creatine is a supplement that primarily benefits elite athletes, who use the substance in conjunction with a scientifically mapped eating and exercise program.
- Creatine will only aid the increase of muscle mass in athletes who do intensive muscle workouts on a daily basis.