

# Bigger and stronger with creatine

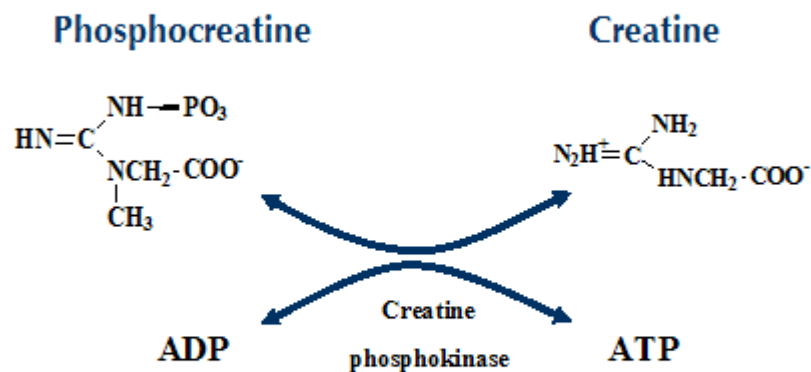
A recent Internet search for "creatine yielded over 900,000 "hits". Most of these are announcements about creatine dietary supplementation aimed to build bigger and better bodies. What is this all about?

## Creatine and creatine phosphate's role in muscle metabolism.

As I have discussed earlier, all muscle work is powered by ATP. It is the power in the high-energy gamma bond that drives actin-myosin coupling and muscle contraction. In spite of this, ATP levels are unusually stable even in working muscles due to several ATP-buffering systems. [Click here to review this.](#)

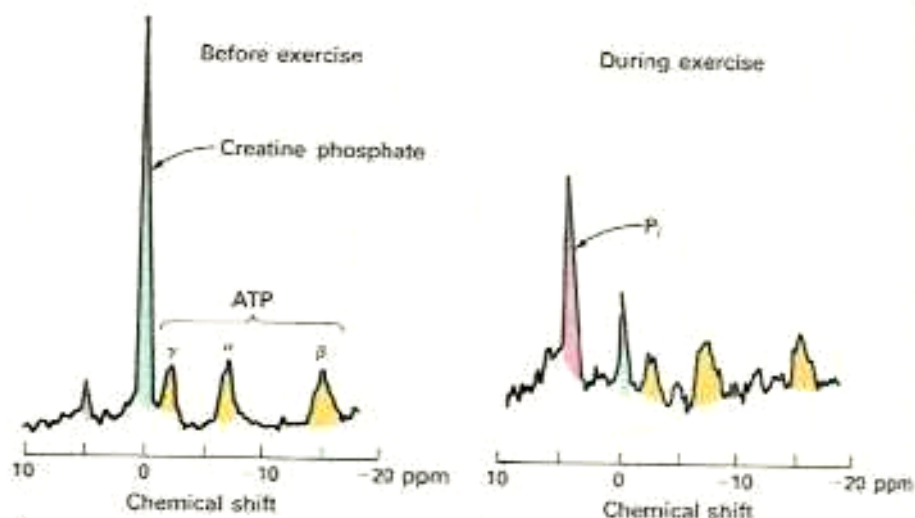
The creatine phosphate-creatine phosphokinase system is the most rapid of these ATP-buffering systems. The equilibrium between creatine, creatine phosphate, ADP and ATP is summarized in the figure below. ATP concentration in skeletal

### Phosphocreatine-ATP Interaction



muscle lies around 5 mmol/kg while one finds approximately 15-20 mmol/kg of creatine phosphate. Thus small changes in the ATP/ADP ratio are quickly evened out by use of creatine phosphate.

This has been decisively shown in the human forearm through the use of magnetic resonance as shown in the next figure. Here we can see the concentrations of inorganic phosphate, creatine phosphate and the three phosphate groups in ATP. Measurements were taken at rest and during a vigorous exercise period. The yellow peaks represent ATP's phosphate groups.



These remain unchanged while exercising while creatine phosphate levels were markedly reduced (green peak) and inorganic phosphate (red peak) was markedly increased. (Figure from G. K. Radda, *Science* 233, 641, 1986 as presented in Lubert Stryer's *Biochemistry*)

A logical conclusion might be that, if one could just increase creatine phosphate levels in muscles, one would be able to carry out more muscle work. The problem with this is that most studies of the effects of creatine supplementation have not shown enhanced strength. This is not surprising of several grounds. First, creatine and creatine phosphate are ionized compounds at physiological pH levels. Accumulation of large amounts of these in muscle would increase osmolarity and lead to muscle water uptake and swelling. Secondly, creatine phosphate has an extremely rapid turnover and an eventual increase in creatine phosphate would be quickly exhausted.

Current evidence suggests that creatine can possibly increase performance lasting for no more than 30 seconds. Creatine supplementation does not appear to increase muscle mass. Please go to a good review article by Paddon-Jones et al, "Potential Ergogenic Effects of Arginine and Creatine Supplementation" [Journal of Nutrition 134:2888S-2894S, October 2004](#) for more information.

In spite of many studies which have not revealed effects of creatine on muscle strength, the market for creatine products in some countries is very large. Dietary supplements containing creatine, ribose, maltose, chrome and amino acids are available on the Internet and appear to be popular.

**The bottom line is that there is little or no basis for dietary supplementation with creatine!**