

Effect of creatine on contractile force and Ca²⁺-sensitivity in mechanically-skinned single fibres from rat skeletal muscle

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Increasing the intramuscular stores of total creatine (TCr = creatine (Cr) + Cr phosphate (CrP)) can result in improved muscle performance during certain types of exercise in humans. It has been suggested that this ergogenic effect may be due to increased CrP levels that thereby enhance the capacity to maintain ATP stores¹. Initial uptake of Cr is accompanied by an increase in cellular water to maintain osmotic balance, but this results in a decrease in myoplasmic ionic strength because Cr is not an electrically charged molecule. Adult Long Evans hooded rats were killed by an overdose of halothane, as approved by the Animal Ethics Committee at La Trobe University and the soleus (SOL) and extensor digitorum longus (EDL) muscles were removed. Mechanically-skinned single fibres from the SOL and EDL muscles were then used to examine the direct effects on the contractile apparatus of increasing [Cr], increasing [Cr] plus decreasing ionic strength, and increasing [Cr] and [CrP] with no change in ionic strength. Increasing [Cr] from 19 to 32 mM, accompanied by appropriate increases in water to maintain osmolality, had appreciable beneficial effects on contractile apparatus performance. These were similar in both SOL and EDL fibres with Ca²⁺-sensitivity and maximum Ca²⁺-activated force increased by ~10% and 6%, respectively. In contrast, increasing [Cr] alone had a small inhibitory effect on Ca²⁺-sensitivity and maximum Ca²⁺-activated force. When both [Cr] and [CrP] were increased there was virtually no change in Ca²⁺-sensitivity of the contractile apparatus and maximum Ca²⁺-activated force was increased ~6% compared to control conditions. These results suggest that the initial improvement in performance observed with Cr supplementation is due in large part to direct effects of the accompanying decrease in myoplasmic ionic strength on the properties of the contractile apparatus.

- (1) Terjung R.L., Clarkson P., Eichner E.R., Greenhaff P.L., Hespel P.J., Israel R.G., Kraemer W.J., Meyer R.A., Spriet L.L., Tarnopolsky M.A., Wagenmakers A.J. & Williams M.H. American College of Sports Medicine roundtable. The physiological and health effects of oral creatine supplementation (2000) *Medicine and Science in Sports and Exercise*, 32, 706-17.