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Supplementation with Micronized Creatine Improves Sarcoplasmic Reticulum Function in Dystrophic Skeletal Muscle

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INTRODUCTION: Muscular Dystrophy is a genetic disease that affects over 1 million American males. It causes severe muscle wasting and death before the patient is 30 years of age. The progressive degeneration characteristic of this disease is the inability to control calcium (Ca^{2+}) flow within muscle. A method of improving the Ca^{2+} handling capacity of dystrophic muscle could be of potential therapeutic benefit in controlling the degenerative aspects of this disease.

In muscles, Ca^{2+} resides in a network of tubules called the sarcoplasmic reticulum (SR). Upon activation by the brain, Ca^{2+} is released from the SR into the muscle fiber where it binds to specific sites to initiate and control muscle contraction. This process is essential for all movement, including intense exercise. Effective release and uptake of Ca^{2+} within the SR is essential to athletic performance as muscle coordination, contractile force and muscle fatigue are all related to Ca^{2+} flow in muscle. Therefore a compound that improves Ca^{2+} handling in muscle may enhance muscle efficiency and athletic performance.

METHODS: In this study we have investigated SR Ca^{2+} uptake activity in dystrophic skeletal muscle taken from mice following supplementation with micronized creatine. Dystrophic mice were randomly separated into non-supplemented (n=8) and creatine-supplemented (n=8) groups. A third group of normal mice was used for comparisons between normal and dystrophic animals (n=8). The creatine was administered in normal chow over a 6-week period. On the day of experimentation, animals were anaethetised and the tibialis anterior (TA) muscle and diaphragm muscle were extracted. SR Ca^{2+} uptake rate was measured spectrofluorometrically in muscle vesicle preparations using the Ca^{2+}-specific fluorophore, Fura-2.

RESULTS: Supplementation with micronized creatine improved SR Ca^{2+} uptake rate in dystrophic muscle. The muscle taken from dystrophic mice supplemented with micronized creatine showed significantly faster SR Ca^{2+} uptake rates in the TA and diaphragm muscle compared to non-supplemented dystrophic muscle ($P<0.05$).

CONCLUSIONS: These results indicate dietary supplementation with micronized creatine improved SR Ca^{2+} uptake activity by increasing ATP availability to the Ca^{2+}-ATPase pump, and could thus potentially be used as a therapeutic adjunct for the treatment of muscular dystrophy.

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