

Editorial

Does Creatine Supplementation Enhance Athletic Performance?

In this issue of *The Journal of the American College of Nutrition* Williams et al [1] provide a comprehensive and up to date literature review of the influence of oral creatine (N-(aminoiminomethyl)-N-methyl glycine) supplementation upon exercise performance. Specifically, the authors have compiled data from 31 studies involving short term (≤ 30 seconds) high intensity performance; data from 14 studies involving more prolonged (17730 to ≤ 150 seconds) performance; and data from eight studies involving aerobic (> 150 seconds) exercise performance.

It was concluded that performance was increased in most studies (21 trials) involving short exercise bouts lasting 30 seconds or less, whereas in more prolonged activities (30 to 150 seconds) fewer studies (five trials) showed improved performance. Only two of eight studies involving aerobic exercise demonstrated enhanced performance with creatine supplementation. Further, the improvement in performance for all durations of activity generally occurred under laboratory conditions utilizing specific exercise tests that would not necessarily mimic conditions during competition in the field. Of the four field studies [2-5] evaluating the ergogenic effect of creatine supplementation on short exercise bouts (sprinting, swimming) lasting 30 seconds or less, all four studies failed to demonstrate improved performance. Of the five field studies [3,4,6-8] involving activities (swimming, running) lasting between 30 and 150 seconds, only a single study [8] indicated improved performance with creatine supplementation.

Although the compilation of studies by Williams et al [1] is suggestive that creatine supplementation has little or no effect upon athletic performance under field conditions, no attempt was made by the authors to determine the effect size (Es) of the treatment (either under laboratory or field conditions) using meta-analytical procedures. Such an analysis would be useful in future compilations and would allow a statement about the average Es of creatine supplementation across studies. Additionally, it is quite likely that creatine supplementation may be less effective in elite or highly trained athletes. A recent meta-analysis of creatine supplementation studies by Mujika and colleagues [9] indicated that elite and highly trained athletes performing single competition-like exercise tasks did not benefit from creatine supplementation. In the present analysis by

Williams et al [1] only 30% of the short duration (≤ 30 seconds) exercise studies in either elite or highly trained athletes showed an improvement with creatine supplementation, whereas 71% of similar studies using non-athletes demonstrated improved performance with creatine supplementation. Because of the varying designs and sample sizes of these studies, a more useful interpretation would require an estimate of Es.

There appears to be little doubt that dietary creatine loading can increase total muscle creatine concentrations (free creatine + phosphocreatine (PCr)) both in humans [10,11] and in rats [12]; however, it does seem to be dose dependent [6,11]. When exercise bouts are induced by laboratory apparatus in non-athletes, the majority of the evidence would support the hypothesis that power output (particularly during repetitive, high-intensity exercise with short recovery periods) can be substantially increased with dietary creatine supplementation. Presumably, elevated intramuscular PCr stores allow high rates of adenosine triphosphate (ATP) re-synthesis to occur via donation of PCr's phosphate group to adenosine diphosphate to form ATP. Because ATP stores are limited in muscle, elevated PCr levels are presumed to facilitate increased ATP synthesis and flux during high intensity exercise.

Although the review by Williams et al [1] provides important clues regarding the exercise conditions under which creatine supplementation may enhance performance, it leaves many questions unanswered. Presently, there are too few field studies of performance to be able to unequivocally contend that field performance cannot be improved by creatine supplementation. Further it is not entirely clear why some experiments have been able to demonstrate improved performance with short-term, high-intensity exercise bouts under laboratory settings whereas others have not. Additional studies are needed to firmly establish that highly trained and elite athletes do not benefit from creatine supplementation when performing single competition like exercise tasks. Further, mechanisms defining differential effects of creatine supplementation under laboratory and field conditions between non-athletes and athletes will need to be formulated and tested. Finally, because creatine supplementation is being used by healthy individuals in an effort to enhance

performance, future investigations should include clinical variables in an attempt to elucidate any potential negative side effects from acute or chronic supplementation [13].

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Loren Cordain, PhD

Department of Exercise and Sport Science
Colorado State University
Fort Collins, CO

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