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## INTRODUCTION

Whilst, scientific evidence is now accumulating regarding the potential benefit of creatine as an ergogenic aid (Harris et al, 1992; Havenetidis et al, 1995), limited information exists for elite performers exercising in an ecologically valid environment. The present study aimed to determine the effects of 2 periods of 4 days supplementation with 25g of creatine each day separated by a period of four months, on the performance of a group of elite swimmers.

## METHODS

A total of twenty one subjects (eleven males and ten females) participated in the present study. Five male and two female subjects (experimental group), participated in the experiments conducted pre and post the first creatine supplementation. Five of them participated in the interval session measurements pre and post the second creatine supplementation. Fourteen swimmers served as two control groups. In the first week of testing no supplements were given, while in the second and third week placebo and creatine were ingested respectively. Although the placebo and creatine conditions were always administered in this order they were conducted as a double blind protocol for the subjects and the test administrators. For the second creatine supplementation (4 months later) baseline measures were followed by creatine ingestion and post supplementation testing. The creatine dosage used, was five times 5 g of creatine separated by 1.5 hours, each day for a period of 4 days. During both periods of creatine supplementation subjects, according to their preferred swimming distance, performed one of three interval sessions (A= 10x50 m, B= 8x100 m and C=15x100 m at maximal speed off 1 minute, 2 minutes and 1 minute and 40 seconds, respectively). The swimmers' race times (n=6) were also recorded pre and post each supplementation period. The swimming races recorded were the Leicester Meeting (18 November 1994), the Sheffield Meeting (11 December 1994) for the first loading and the Leeds Meeting (24 February 1995) the Sheffield Meeting (20 April 1995) for the second loading. Times for the 50 m or 100 m intervals were measured by experienced coaches with the use of stopwatches whilst competition times were measured with electronic timing.

## RESULTS

For the first creatine supplementation no difference in the average swim times was found between the baseline and placebo condition (mean times), whilst a Friedman Analysis of Variance with ranks showed a significant difference between the placebo and creatine condition for the interval session ( $P < 0.05$ ). Mean rank for baseline, placebo and creatine was 2.3, 2.5 and 1.1 respectively. The mean group swimming times for the baseline, placebo and creatine conditions were  $48.38 \pm 18.05$  s,  $48.36 \pm 18.14$  s and  $48.02 \pm 18.19$  s respectively, which produced an average improvement of 0.34 s (0.7%) comparing the creatine with the placebo condition. In contrast, the difference between the baseline and placebo was, on average, 0.02 s. Following the second creatine supplementation the swimmers showed a significant improvement in their interval session times ( $P < 0.05$ ; Wilcoxon) as measured against baseline times recorded prior to the supplementation ( $57.89 \pm 15.57$  s and  $57.23 \pm 15.36$  s respectively) (difference  $0.66 \pm 0.43$  s) (Figure 1). A Wilcoxon test for related samples showed a significant ( $P < 0.05$ ) improvement in race times at Sheffield compared to Leicester ( $4.45 \pm 7.04$  s) (first loading) and at Leeds compared to Sheffield ( $8.50 \pm 9.21$  s) (second loading). In contrast, no significant differences were found between the same meetings for the control groups who did not ingest creatine. Mean  $\pm$  SD race time values pre-post creatine for the first loading were  $221.3 \pm 367.5$  s and  $227.3 \pm$

383.5 s respectively whilst for the second loading were  $266.4 \pm 318.8$  s and  $266.5 \pm 322.1$  s respectively (Figure 2).

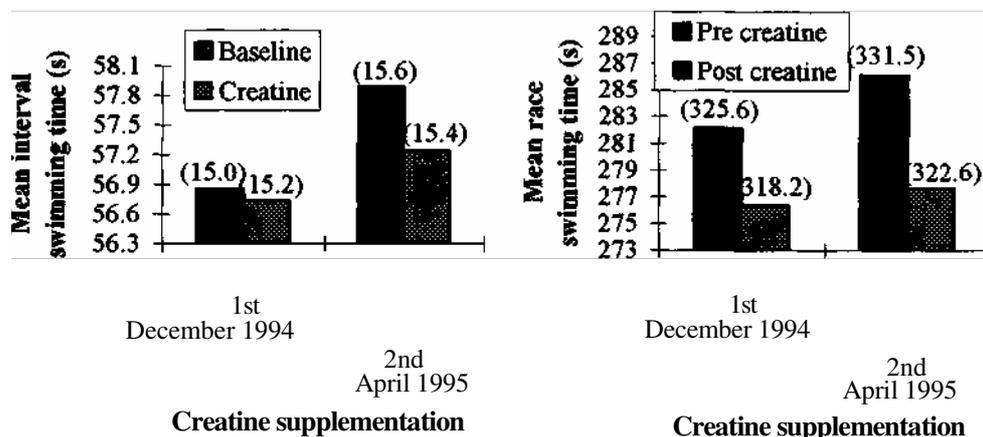


fig. 1 and 2: Mean  $\pm$  SD swimming time values during the interval sessions (n=5) and races (n=6) for the same sample group participating in both creatine supplementations (Standard deviation appears in brackets).

## DISCUSSION

Swimmers improved their race performances following the first and second creatine ingestion (Sheffield meeting) (2.1%) and (3.0%) respectively and this improvement was greater than that observed in the swimming intervals (0.7%) and (1.1%) respectively. Such an improvement is of great significance for an elite swimmer representing the difference between winning a medal and qualifying for a final. Three out of the six swimmers in the experimental group improved their personal best performance times following creatine ingestion (one breaking the Yorkshire record and narrowly missing the British Record) Since both the experimental and control group followed the same preparation and training prior to these meetings, the improvement observed for the experimental group is more likely to be related to the ergogenic effects of creatine ingestion. The present study also showed that the beneficial effects of creatine supplementation can be repeated and even magnified when another creatine supplementation is used four months later.

The mechanisms responsible for the improved performance with creatine supplementation have been postulated to be both higher creatine phosphate content pre exercise and an improved capacity for creatine phosphate resynthesis within the muscle. In the present study all swimmers improved their race performances therefore the elevated CP levels prior to exercise can be put forward as the main mechanism for this potentiation. However, it may be that the increased resynthesis during recovery played the most important role in the improved race performance. An increased CP resynthesis during rest and/or exercise could be related to an increased buffering capacity since the increased CP stores produce a more efficient control of pH. As long as the CP-Cr reaction is present there is a steady reduction of hydrogen ions. These observations suggest that the elevated CP levels may have indirectly facilitated exercise recovery via increases in buffering capacity which contributed significantly to the potentiation of exercise performance.

## REFERENCES

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