

## Effects of a Six-Day Carbohydrate/Protein Intervention on Muscle Damage, Soreness, and Performance in Runners

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Carbohydrate/protein (CHO+P) beverages have been reported to improve endurance performance and attenuate muscle damage and soreness compared to carbohydrate-only (CHO) beverages. However, these measures have not been examined in runners, or during nutritional interventions that lasted more than two days.

**PURPOSE:** The purpose of this study was to investigate the effects of a six-day regimen of CHO+P post-exercise beverage consumption on muscle damage, muscle soreness, and race performance versus a CHO beverage.

**METHODS:** Twenty-three NCAA Division I cross-country runners (11 males/12 females;  $VO_{2max} = 60.9 \pm 8.5 \text{ mL} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$ ) completed traditional in-season training for six days prior to a cross-country race. Immediately following each training session, subjects ingested  $10 \text{ mL} \cdot \text{kg}^{-1} \cdot \text{BW}^{-1}$  of a 14.6% CHO beverage or a 14.6+3.65% CHO+P beverage (which were administered in a randomly counter-balanced, double-blind design). Following a 21 -day washout period, subjects repeated the same protocol as above, receiving the alternate beverage. Plasma CPK and muscle soreness were obtained the morning prior to intervention onset and were compared to samples obtained on the sixth day. Race performance was assessed using the athlete's finishing position (rank) among the male (8km) and female (5km) groups. A two-way repeated measures ANOVA was used to analyze differences in CPK between treatments, while muscle soreness and running performance were analyzed using a Wilcoxon Signed Rank Test between beverage treatments.

**RESULTS:** After five days of beverage administration, plasma CPK was significantly lower ( $p < .05$ ) in the CHO+P trial ( $223.21 \pm 160.71 \text{ U/L}$ ) versus CHO ( $307.3 \pm 312.9 \text{ U/L}$ ) despite no differences in baseline CPK ( $225 \pm 108 \text{ U/L}$  vs.  $229 \pm 100 \text{ U/L}$ ). Similarly, post-intervention muscle soreness was significantly lower in the CHO+P trial ( $1.15 \pm 1.14$ ) versus the CHO trial ( $1.65 \pm 1.09$ ), despite no differences in pre-intervention levels soreness. However, there was no significant difference in performance rank between CHO ( $6.30 \pm 3.3$ ) and CHO+P ( $6.26 \pm 3.4$ ) treatments.

**CONCLUSIONS:** Muscle recovery (plasma CPK and muscle soreness) was enhanced with the ingestion of a CHO+P recovery beverage compared to a CHO recovery beverage. The present data did not demonstrate enhanced cross-country race performance. However, levels of muscle damage and soreness were relatively low during both treatments in this study. Because neither group demonstrated high levels of muscle damage, the recovery benefits of the CHO+P intervention may not have been large enough to cause observable improvements in running performance.