

Inter-Study Examination of Physiological Variables Associated with Improved Endurance Performance with Carbohydrate/Protein Administration

Saunders, Michael J. FACSM¹; Todd, M. Kent FACSM¹; Valentine, Rudy J.¹; St. Laurent, Thomas G.¹; Kane, Mark D.¹; Luden, Nicholas D.¹; Herrick, Jeffrey E.²

¹James Madison University, Harrisonburg, VA, ²Virginia Commonwealth University, Richmond, VA

PURPOSE: Previous studies from our laboratory reported improvements in endurance performance when athletes consumed carbohydrate/protein (CHO+P) beverages or gels compared to carbohydrate-only (CHO) treatments. However, relatively small sample sizes in these studies precluded the ability to examine correlations between physiological variables that may have been associated with performance benefits. Therefore, the purpose of this study was to examine data across multiple studies to determine if improvements in performance were related to alterations in physiological measures during exercise.

METHODS: Subjects (n=38) were pooled from three studies in which cyclists performed rides to exhaustion at 75% VO_{2peak} . In each study, cyclists received CHO (7.3%) or CHO+P (7.3+1.8%) every 15 minutes during exercise, using a randomly counterbalanced double-blind design. VO_2 , heart rate (HR), blood glucose, lactate, RER and RPE were compared between treatments at 30-min of exercise, as it was a common measurement time for all subjects in all studies.

RESULTS: Time to exhaustion was 19% longer ($p<.05$) in the CHO+P trial (116.5 ± 33.9 min) than the CHO trial (97.8 ± 32.4 min). There were no differences in VO_2 (2.89 ± 0.58 ; 2.86 ± 0.61 L/min), blood glucose (83.1 ± 14.5 ; 82.4 ± 17.8 mg/dL), and RER ($.95\pm.03$; $.95\pm.03$) between CHO and CHO+P treatments respectively. Heart rate (163.3 ± 14.0 ; 159.3 ± 14.1 bt/min), RPE (14.6 ± 2.0 ; 14.1 ± 2.0) and lactate (3.4 ± 1.3 ; 2.9 ± 1.5 mmol/L) were significantly lower ($p<.05$) during the CHO+P trial. Differences in performance between treatments (CHO+P time minus CHO time) were significantly correlated ($p<.05$) with treatment differences in exercise responses for HR ($r=.410$) and RPE ($r=.306$) but not lactate ($r=.065$). Similarly, individuals with relatively large improvements in performance time with the CHO+P beverage (>10 min, $n=26$) had significantly larger differences between treatments in HR and RPE, but not lactate than those with <10 minute differences in performance ($n=12$).

CONCLUSIONS: Combined data from three studies revealed significant improvements in endurance performance with CHO+P versus CHO supplementation. While HR, RPE and lactate were lower in CHO+P trials, only decreases in HR and RPE were associated with improvements in performance. The magnitude of differences in HR and RPE do not appear large enough to explain the comparatively large improvements in performance with CHO+P beverages. The underlying mechanism(s) that produce performance improvements with CHO+P beverages may also produce the physiological alterations in HR, RPE and lactate observed in this study.