A 0.8 Fructose:Maltodextrin Ratio Enhances Endurance Performance and Exogenous Carbohydrate Oxidation

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Abstract

Introduction: A ratio of fructose to glucose/maltodextrin of approximately 0.8 in a carbohydrate-electrolyte solution ingested during endurance exercise was recently seen to substantially increase exogenous-carbohydrate oxidation, gut comfort and performance. However, it remains to be determined if the apparent fructose:glucose ratio optima is robust when the possible confounders of differences in solution osmolality and carbohydrate concentration are removed from consideration via clamping, and if the 0.8 ratio also promotes faster fluid absorption.

Methods: In a randomised double-blind crossover, 12 male cyclists rode 2 h at 57.5% peak power, then performed 10 repeated-maximal-sprints, while ingesting artificially sweetened water or one of three isomotic 11.25% carbohydrate-salt solutions at 800 $mL \cdot h^{-1}$, comprising fructose and, maltodextrin/glucose, at the respective mean rates ($g \cdot min^{-1}$): 1.0, 0.5 (0.5-Ratio); 0.67, 0.83 (0.8-Ratio); 0.83, 0.67 (1.25-Ratio). Each solution was also spiked with 5 g D_2O at 30 min into the 2-h preload. ^{14}C-enriched fructose and naturally ^{13}C-enriched maltodextrin/glucose permitted fructose and glucose oxidation rate evaluation by liquid scintillation and mass spectrometry, respectively, and indirect calorimetry.

Results: Mean exogenous-fructose and mean exogenous-glucose oxidation rates were 0.27 (SD%, 46), 0.39 (56) and 0.46 $g \cdot min^{-1}$ (53), and 0.65 (30), 0.71(14) and 0.58 (28) $g \cdot min^{-1}$ in 0.5-, 0.8- and 1.25-Ratio, respectively; representing oxidation efficiencies (%) for fructose of 56 (12), 60 (7) and 56 (10), for glucose of 67 (16), 86 (11) and 89 (21), and for total exogenous-carbohydrate of 70 (9), 74 (6) and 64 (9), respectively. Relative to 0.5- and 1.25-Ratios, total exogenous-carbohydrate oxidation rate with 0.8-Ratio was very likely 6.4% (90% confidence limits; ±3.1%) and almost certainly 12.7% (±2.6%) higher, respectively, while respective differences in total-exogenous carbohydrate oxidation efficiency was 4.1±1.8% and 8.8 ±1.9%. Endogenous-carbohydrate oxidation with 1.25-Ratio was very likely higher relative to 0.5- and 0.8-Ratio conditions (31.3%; ±26.6% and 37.3%; ±27.8%, respectively) but comparisons of fat and total-carbohydrate oxidation rates were unclear among carbohydrate solutions. Mean sprint power with 0.8-Ratio was moderately higher than 0.5-Ratio (2.9%; 99% confidence limits ±2.8%) and 1.25-Ratio (3.1%; ±2.7%), and almost certainly higher than Water (11.9%; ±3.0%); repeated-sprint fatigue (slope) was possibly attenuated with 0.8-Ratio compared to 0.5- and 1.25-Ratio (2.1%; ±5.7% and 1.7%; ±5.5%, respectively). Blood D_2O enrichment differences were possibly small or inconclusive among all solutions. Differences in gastrointestinal comfort during the 2-h ride were trivial/unclear among the carbohydrate conditions, however, increases in abdominal cramping were likely greater with 0.8-Ratio during the performance test.

Conclusions: Substantial enhancement of endurance performance results from ingestion of 0.8 ratio fructose:maltodextrin/glucose solutions, which is associated with increased exogenous-carbohydrate oxidation efficiency driven largely by a greater contribution from exogenous-fructose oxidation. Further research is required to determine the effect on fluid absorption and the physiological site responsible for the 0.8 ratio effect.

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