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The effect of carbohydrate dose and timing on timed effort and time to exhaustion within a simulated cycle race in male professional cyclists

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A key performance limitation affecting professional endurance cycling is carbohydrate storage and utilisation (Pöchmüller, Schwingshack, Colombani & Hoffmann, 2016, *Journal of the International Society of Sports Nutrition*, 13). Muscle glycogen stores alone are inefficient at maintaining optimal blood glucose levels beyond two hours of exercise; consequently, exogenous CHO is commonly used to counteract this (Jeukendrup, 2011, *Journal of Sports Sciences,* 21, 91-99). High concentrations of CHO can cause drops in blood glucose, excessive glycogen utilisation and gastrointestinal discomfort (GID) (Jeukendrup, 2011). Therefore, the aim of this study was to determine if frequent, smaller CHO feedings would be preferable to large, bolus CHO feedings on time trial cycling performance. With institutional ethics approval, 5 professional cyclists completed a 4h simulated cycle ride with 3 timed efforts in a randomised, cross-over, double blind design study. Each timed effort occurred in the last 10 min of each hour (TE1, TE2, TE3); participants were asked to cycle with maximum effort for this time. There was also a final effort at the end of the 4th hour to replicate a sprint finish. This was measured as time to exhaustion (TTE). Two interventions were used; a frequent feed (F) where participants drank 20g maltodextrin in 300ml flavoured water solution 3 times per hour and a bolus feed (B) where participants drank 60g maltodextrin solution once per hour. Heart rate, power output, GID, perceived exertion (RPE), blood lactate and blood glucose were recorded before and after TE1, TE2, TE3 and TTE. Wilcoxen signed rank test and Cohen's D was performed to study differences between interventions and effect sizes.In the F intervention, average watts were significantly higher at TE2 (P<0.05 d=0.75) and TE3 (P<0.05 d=1.21) and the RPE was lower TE1 (P≥0.05 d=1.12), TE2 (P<0.05, d=1.12) and TTE (P≥0.05 d=1.12) compared to B. There was no significant difference between any other variables. The results suggest that despite power output being higher, RPE was lower in the F intervention. Gut absorption of CHO is limited to 1g/h (Jeukendrup, 2011), which may help explain these findings. This is one of the first studies to look at concentration and timing of CHO consumption in endurance cycling. Regular feeds of 20g CHO may be more beneficial on power output and RPE in endurance cycling compared to hourly 60g feeds.