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CAN CARBOHYDRATE AND PROTEIN INTAKE PREVENT GUT- IMMUNE PERTURBATIONS INDUCED BY EXERTIONAL-HEAT STRESS?

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Physical exertion in hot ambient conditions perturbs the integrity of the gastrointestinal tract leading to endotoxaemia and subsequent systemic cytokine responses. Such perturbations have been linked to gastrointestinal symptoms and adverse health and performance implications. To date, it is unknown whether nutrient intake, which is a common-practice during prolonged exercise, can attenuate gastrointestinal perturbations induced by exertional-heat stress (EHS). The study, therefore, aimed to determine the effects of carbohydrate and protein intake during EHS on intestinal injury, permeability and inflammation, gastrointestinal symptoms, systemic endotoxin and cytokine responses. Using a randomised repeated-measures design with one week washout, eleven endurance runners completed 2 h running at 60% VO2max in 35°C (27% relative humidity) consuming either 15g glucose (6% w/v) (GLUC), energy-matched whey protein hydrolysate (WHEY), or water (WATER) before and every 20 min during exercise. Rectal temperature and gastrointestinal symptoms were recorded every 10 min during exercise. Blood samples were collected pre- and post-exercise, and during recovery to determine plasma intestinal fatty-acid binding protein (I-FABP), cortisol, endotoxin, and cytokine concentrations. Pre- and post-exercise faecal samples were collected to determine calprotectin. Urinary lactulose:rhamnose was used to measure small intestinal permeability. GLUC and WHEY abolished the post-exercise increase in I-FABP (trial*time, p<0.001) and reduced small intestinal permeability compared to WATER (trial effect, p=0.002); with WHEY reducing small intestinal permeability more than GLUC (p<0.05). Total- and upper-gastrointestinal symptoms were greater with WHEY, compared to GLUC and WATER (p<0.05). Endotoxaemia was observed post-exercise (10.2pg/ml);
time effect, *p*=0.001), with no difference between trials. However, post-exercise anti-endotoxin antibodies were higher on GLUC (p<0.01) and WHEY (p<0.05) compared to WATER, indicating improved endotoxin clearance capacity with nutrient intake. Plasma IL-6 and cortisol concentrations increased post-WATER, and were higher than GLUC, but not WHEY (trial*time, *p*=0.048 and *p*<0.001, respectively). Plasma IL-8, IL-10 and IL-1ra concentrations increased post-exercise on all trials (time effect, *p*<0.01). No differences were observed pre- to post-exercise or between trials for plasma IL-1â, TNF-a and faecal calprotectin concentrations. Anti-endotoxin antibodies were negatively associated with I-FABP, permeability and inflammatory cytokines (p<0.05). In conclusion, carbohydrate (i.e., glucose) and protein (i.e., whey) intake during EHS reduces intestinal injury and small intestinal permeability, supports endotoxin clearance and improves inflammatory cytokine profiles. However, protein appears to contribute to the development of gastrointestinal symptoms, making carbohydrate a more appropriate recommendation for supporting gut-immune health during EHS.