

The effect of a pre-exercise carbohydrate meal on immune responses to an endurance performance run

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This study examined the effect of a pre-exercise meal with different glycaemic index (GI) and glycaemic load (GL) on immune responses to an endurance performance run. Eight men completed a preloaded 1 h run at 70% $\text{VO}_{2\text{max}}$ on a level treadmill followed by a 10 km performance run on three occasions. In each trial, one of the three prescribed isoenergetic meals, i.e. high GI and high GL (H-H), high GI and low GL (H-L), or low GI and low GL (L-L) was consumed by the subjects 2 h before exercise. Carbohydrate intake (% of energy intake), GI, and GL were 65%, 79.5, and 82.4 for H-H; 36%, 78.5, and 44.1 for H-L; 65%, 40.2, and 42.1 for L-L, respectively. The running time for the three trials was approximately 112 min at 70% $\text{VO}_{2\text{max}}$ for the first hour and 76% $\text{VO}_{2\text{max}}$ for the last 52 min. Consumption of pre-exercise high-carbohydrate meals (H-H and L-L) resulted in less perturbation of the circulating numbers of leucocytes, neutrophils and T lymphocyte subsets, and in decreased elevation of the plasma IL-6 concentrations immediately after exercise and during the 2 h recovery period compared with the H-L trial. These responses were accompanied by an attenuated increase in plasma IL-10 concentrations at the end of the 2 h recovery period. The amount of carbohydrate consumed in the pre-exercise meal may be the most important influencing factor rather than the type of carbohydrate in modifying the immunendocrine response to prolonged exercise.

Glycaemic index: Glycaemic load: Carbohydrate: Performance run

Previous studies have indicated that ingesting carbohydrate (CHO) beverages at regular intervals during prolonged, strenuous exercise is associated with smaller perturbations in the total and differential circulating leucocyte counts and attenuated reduction in functional responses in a number of immune cells and mediators, including lymphocytes, neutrophils and inflammatory cytokines^(1–4). The effect of a CHO food on immune response is relatively small. However, the limited data still suggested that pre-exercise low-CHO meals increased the magnitude of leucocytosis and a rise in the neutrophils in the blood^(1,5). It seems likely that part of the underlying mechanism behind these responses is an attenuation of the cortisol response to the exercise and maintenance of plasma glucose concentrations^(1,6).

The glycaemic index (GI) describes the difference by ranking CHO according to their effect on blood glucose levels compared with a reference food, which may be either glucose or white bread⁽⁷⁾. Numerous studies have suggested that a low-GI meal consumed at different times, i.e. 1–4 h, prior to prolonged exercise can maintain higher

blood glucose concentrations, decrease plasma lactate concentrations during exercise and/or post-exercise, and cause a relative shift in substrate utilization from CHO to fat compared with a high-GI pre-exercise meal^(8–10). Despite the inconsistency on improvement in exercise performance after the ingestion of GI meals^(8–10), most findings indicate that a pre-exercise low-GI meal may have potential benefits over a high-GI meal because of the promotion of the sustained CHO availability during exercise^(10,11). Glycaemic load (GL) was subsequently proposed as a measure that incorporates both the quantity and quality of the dietary CHO consumed⁽¹²⁾. As a mathematical concept, GL has been physiologically validated as a reliable measure of glycaemic response to individual foods across a wide range of portion sizes⁽¹³⁾. It has also been suggested that GL would be a much better predictor for controlling blood glucose levels than just predicting from CHO amount/percentage or GI alone⁽¹⁴⁾. Compared with the number of studies that examined the application of GI in sports nutrition, the concept of GL which is primarily applied in epidemiological

Abbreviations: CHO, carbohydrate; GI, glycaemic index; GL, glycaemic load; H-H L-L and H-L, high GI and high GL, low GI and low GL, and high GI and low GL meals, respectively; T1, 1-h preloaded constant run at 70% $\text{VO}_{2\text{max}}$; TT, time trial.

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