

The effect of low and high glycemic index meals on soccer tournament performance

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Objective

To evaluate the effects of lentils, as a low glycemic index (LGI), high protein meal, and a conventional, high glycemic index (HGI) meal consumed by soccer players prior to tournament play.

Background

- Previous research in our lab demonstrated a significant improvement in performance after lentil consumption before a single soccer match.
- Little work has been done investigating the effects of glycemic index on exercise performance in intermittent sports such as soccer, especially those performing repeated matches in one day.
- No research has looked at female performance in intermittent sports with HGI or LGI meals.

Methods

Test meals

Component	LGI	HGI
Calories	677	677
Carbohydrates	129	119.8
Fat	2.9	13.2
Protein	36	17.8
Fibre	24	7.76
Available CHO	104	112
CHO (g · kg ⁻¹)	1.5	1.6
PRO (g · kg ⁻¹)	0.51	0.25
GI	42	75
Glycemic Load	44	84

Each meal condition (Table 1) was presented in a randomized counterbalanced fashion. The LGI meal was developed to ease consumption of lentils as an early morning option using Saskatoon berries and honey while the HGI meal was comprised of instant mashed potatoes and white bread.

Table 1 – The macronutrient, caloric, and glycemic index of the LGI and HGI meals for each of two trials. Values based on a 70 kg participant

Recruitment and preliminary testing

- Male and female participants with previous experience in competitive soccer or running training involving intermittent intensities were recruited.
- Participants made three preliminary visits to the lab to determine aerobic capacity (VO₂max), meal familiarization and treadmill familiarization. Participants then performed two trials, separated by at least 7 days.

Protocol

- Low glycemic (LGI) and high glycemic (HGI) meals, matched for calories (Table 1) were consumed two hours before a 90-minute soccer match simulation and two hours before a second soccer match simulation performed three hours after the first soccer match (Fig 1) to simulate tournament play.
- The simulated match was made up of 15 minute segments (Fig 2). Segments were repeated to add up to total 45 min. and 30 min. for the first and second halves of each match, respectively.
- During the last 15 minutes of the match, players performed five one-minute sprints separated by a 2.5 minute break. The distance traveled during the sprints acted as a performance measure.

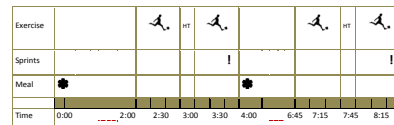


Fig. 1 – Trial day protocol for each of two treatments, HT= half time

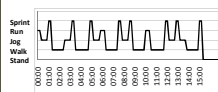


Fig. 2. Treadmill speed protocol for one 15 minute segment.

Data collection

- Blood glucose and blood lactate were measured by commercial meters for two hours after the meal and during each match.
- Venous blood samples were collected before, at half time, and after each match.
- Breath-by-breath gas was collected at three points throughout each soccer match for respiratory exchange ratio (RER), carbohydrate oxidation rate (g · min⁻¹), and fat oxidation rates (g · min⁻¹).
- Rate of perceived exertion (RPE) was assessed with a 14-point scale throughout each match.

Results

- 14 participants completed the study; 10 males, 4 females
 - mean age, weight, height, max HR, and relative VO₂max of the participants was 25.8 ± 7.3 years, 66.9 ± 7.8 kg, 173.3 ± 6.7 cm, 190 ± 15 bpm, 54.8 ± 5.4 ml · kg⁻¹ · min⁻¹.
- Participants reached a mean maximal speed of 16.3 ± 0.5 km · hr⁻¹ and 17.0 ± 0.6 km · hr⁻¹ for females and males, respectively.

Performance and perceived exertion:

Distance travelled at the end of each match, as well as RPE throughout the soccer matches, was similar between the HGI and LGI trials (Fig. 2).

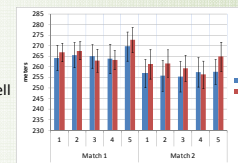


Fig. 2– Sprint performance at the end of each match was similar between HGI and LGI trials (p<0.05).

Blood glucose and blood lactate

Blood glucose was higher during the HGI trial compared to the LGI trial after meal consumption (p<0.05) (Fig. 3). No differences were observed for blood lactate between the trials (data not shown).

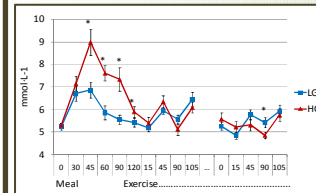


Fig. 3 – Blood glucose was significantly higher in the post-prandial period for the HGI trial compared to the LGI trial (p<0.05).

Serum Analysis

Plasma insulin was elevated at the start of the first match in the high-glycemic index trial (p<0.05) (Fig 4). Blood free fatty acids were similar between both meal conditions throughout the soccer matches (data not shown).

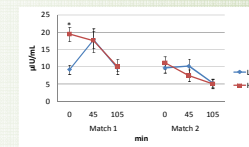


Fig. 4 – Serum insulin was higher in the high glycemic index trial before the first match (p<0.05).

Respiratory Analyses

Carbohydrate oxidation was significantly increased with the HGI trial compared to the LGI trial early in the first match. In addition, during the LGI trial there was a smaller carbohydrate to fat oxidation ratio in comparison to the HGI trial during the early portion of each match. (p<0.05). Fat oxidation rates between the two trials was similar.

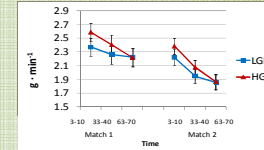


Fig. 4 – Carbohydrate oxidation rates decreased over time for both trials. Carbohydrate oxidation was significantly higher for the HGI trial compared to the LGI trial early in the first match.

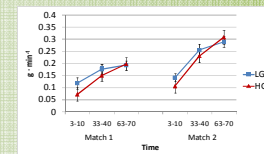


Fig. 5 – Fat oxidation rates increased throughout each soccer match. Fat oxidation was not different between the HGI and LGI trials.

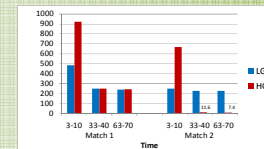


Fig. 6 – Carbohydrate: FAT oxidation rates were higher in the first 10 minutes of each match during the HGI trial compared to the LGI trial (p<0.05).

Conclusions

- While performance was similar between the two trials, the HGI diet (potato-based) and LGI diet (lentil-based) influenced the metabolic profile early in intermittent exercise.
- Lentils, as a low glycemic index, high protein pre-exercise meal:
 - ✓ Improved blood glucose response after meal consumption,
 - ✓ Favourably reduced blood insulin response prior to exercise
 - ✓ Decreased carbohydrate oxidation and carbohydrate to fat oxidation rates at the beginning of exercise, potentially improving energy availability during exercise.

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