WELCOME TO THE SPORTS NUTRITION ELECTIVE

JDRF PEAK
T1D Performance in Exercise and Knowledge

Sports Nutrition – Why?

Sports Nutrition aims to:

- Meet the energy and fuel requirements of the sport
- Achieve and maintain ideal physique
- Enhance adaptation and recovery between training sessions
- Maintain optimal health
- Reduce sickness and injury during heavy training by supporting immune function
- Consider and evaluate the use of supplements
- Promote long term health

Applying Sports Nutrition to Diabetes

- Limited evidence base specific to population with diabetes
- Account for physiological differences
- Consider the role of nutrition & hypoglycemia prevention

CARBOHYDRATE

JDRF PEAK
T1D Performance in Exercise and Knowledge

Carbohydrate – When to Consider & Why

Pre-event/Pre-game meal
2–3 hours before event

Immediately prior to event/game
5–15 minutes before

Immediate recovery
ASAP
(within 60–90 minutes of event/game)

During event/game

Late recover and habitual diet

GAMETIME

Carbohydrate Requirements for Sports Performance and Hypoglycemia Prevention

	No diabetes
Situation	**Sports performance**
Pre-exercise meal	A minimum of 1g CHO/kg BW +/- protein according to exercise intensity and type
Immediately pre-exercise	No CHO required
Up to 30 min duration	No CHO required
30- 60 min duration	Small amounts of CHO may be helpful according to exercise intensity
60- 150 min duration	30-60g CHO/hr
> 150 min duration	60 -90g CHO/hr spread across the activity (eg. 20-30g CHO/20 min) Use CHO sources that utilize different transporters (e.g. glucose and fructose)
Post- exercise meal	1-1.2g CHO/kg BW and 20-30g protein

Bartlett J, Hawley J, Morton J, Eur J Sport Sci, 2015. 15(1):3-12.

Use of Glycemic Index

Theoretical benefit to consuming low GI carbohydrate 1-3 hours before exercise

→

Reduced muscle glycogen utilization and greater fat oxidation

- In practice this does not always translate into performance benefit particularly when carbohydrate is ingested during exercise
- High GI foods immediately post exercise may be of benefit in immediate recovery
- For type 1 diabetes pre exercise low GI choices may impact pre exercise BGL
- Post exercise low GI food choices may impact post exercise BGL and protect against hypoglycemia

JDRF PEAK T1D Performance in Exercise and Knowledge

Glycemic Index - Evidence

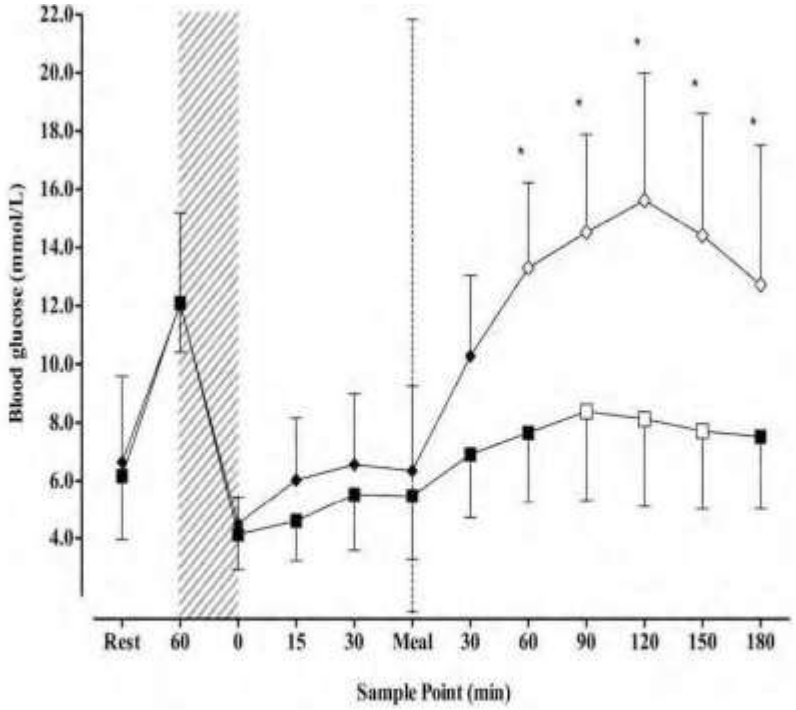


Figure 1 – Time course changes in blood glucose from rest, during exercise, and over 3 h post-exercise. Data are presented as mean ± SD (error bars). ■, LGI; ◆, HGI; □ and ◇, significant difference from pre-meal concentrations ($p \leq 0.05$). *Significant difference between conditions ($p \leq 0.05$). Shaded area indicates exercise; dashed line indicates post-excercise meal intervention. Note that the test meal and insulin were administered immediately following rest and 60 min post-excercise.

- Very limited evidence of benefit for hypoglycemia prevention and sports performance in type 1 diabetes
- Usefulness of the glycemic index is controversial and not well established

- Bracken and colleagues looked at different types of carbohydrate prior to and during exercise in adults with type 1 diabetes
- Demonstrated that low glycemic index (GI) carbohydrates are effective at maintaining glycemia during exercise tests
  - This does not impair performance, and may increase fat oxidation while reducing carbohydrate oxidation

Ingestion of low GI carbohydrates post-exercise with insulin reduction helped prevent hypoglycemia for 8 hours post-exercise

Braken, RM et al. *Med Sci Sports Exerc,* 2012,44(5):800-808
West DJ et al. *Med Sci Sports Exerc,* 2011, 43(2): 204-210

JDRF PEAK T1D Performance in Exercise and Knowledge

PROTEIN

Practical Tips to Maximize Recovery and Protein Synthesis

1. Distribute protein intake evenly across the day consuming around 0.3g/kg per meal for maximum muscle protein synthesis
2. Consume protein at the meal/snacks before and after exercise/training
3. Ideal amount of post-exercise protein is 20-30g. There is little or no benefit with higher amounts
4. Leucine is a key trigger – found in milk, whey, casein, egg, meat, poultry and fish
5. Maximize recovery with a 3:1 or 4:1 ratio of carbohydrate to protein e.g. 60g carbohydrate with 20g protein
6. If exercising again within 24 hours timing of post-exercise recovery meal is crucial. Should be <4 hours after training and ideally within 2 hours

JDRF PEAK T1D Performance in Exercise and Knowledge

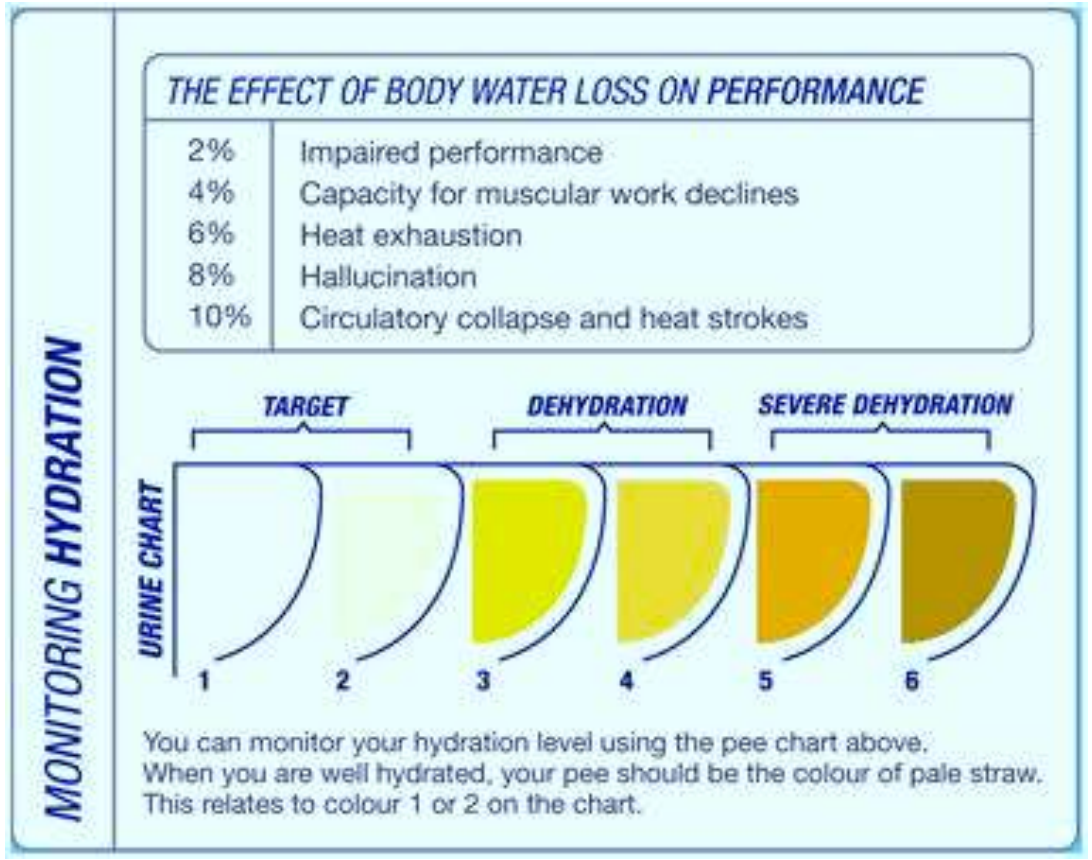
FLUIDS

Fluids

- Fluid requirements impacted by environment = temperature, humidity and altitude plus heat acclimatization
- Avoid over-drinking
- Before exercise ensure adequate hydration 5-7 mL/kg
- During exercise drink to minimize dehydration to less than 2% body weight
- Post-exercise rehydrate with 1.5L fluid for every 1kg weight loss

Practical Fluid Management

- In hot weather chilled fluids or ice pops may help achieve adequate fluid and promote cooling
- Plan when and what to drink – always practice in training
- Assess fluid needs by measuring weight loss during training
- Use hydration charts to assess status before commencing training



National Park Service – US Department of the Interior. https://www.nps.gov/depo/planyourvisit/upload/Urine%20Color%20Chart%20for%20Comfort%20Stations.pdf

Milk as a Recovery Fluid

- Increased body of evidence of benefits of milk consumption post-exercise for muscle protein synthesis, glycogen repletion and hydration

- One early study in type 1 diabetes demonstrated that whole milk post-exercise was more effective than carbohydrate drinks at maintaining post-exercise blood glucose and preventing hypoglycemia

Hernandez JM, *et al. Med Sci Sports Exerc* 2000;32(5):904-10.

JDRF PEAK T1D Performance in Exercise and Knowledge

CASE STUDIES

Group Exercise Adult Case — Lucy

Scenario

- Lucy is 32 years old, she has had diabetes for 10 years and her HbA_{1c} is 7.5% (58mmol/mol). Her weight is 52 kg and height is 5'5"
- She uses insulin pump therapy and makes reductions in her basal rate to manage her BG when running, she rarely adjusts her mealtime bolus insulin doses
- She is training for a half marathon, and struggling with fatigue and late night hypos. She does not take either carbohydrate or fluid on board during her runs
- She has come to you for advice about nutritional supplements to help with her fatigue. She is worried about increasing her food intake as she does not want to gain weight
- She is running 4 times a week, 3 evenings after her evening meal and on Sunday mornings before breakfast. Evening runs average 60 mins and the Sunday run is longer ~90 mins
- Lucy works full time in an office-based job (Monday – Friday)

JDRF PEAK
T1D Performance in Exercise and Knowledge

Lucy

Questions

- What do you think is contributing to Lucy's fatigue?
- What advice would you give Lucy about supplements?
- How much carbohydrate does Lucy need?
- What eating/nutrition strategies might you suggest?
- What other aspects of Lucy's health might you want to explore?

Lucy

- What do you think is contributing to Lucy's fatigue?
  - Inadequate carb intake, Fluid intake, Hypos, Hyperglycemia, Iron levels, Mental health
- What advice would you give Lucy about supplements?
  - Focus initially on getting it right with food, assess need for any specific supplements e.g. iron or calcium or Vit D.
  - Supplements may be useful for times when difficult to carry/consume adequate carbohydrate e.g. gels or sport drinks during runs
- How much carbohydrate does Lucy need?
  - Approx 4-5 g/kg/day as a starting point, will depend on amount training and adaptation
  - 30 g/hr during runs lasting longer than 60 minutes to help with fatigue and hypo prevention, need to consider practicality and tolerability
    - May need a bit more or less depending on adjustments to insulin
    - After exercise requires 50-60 g at breakfast or 30 g CHO with 20-30 g protein. (Consider having dinner after exercise so not bolusing and then running)
  - Distribute carbohydrate across day and adjust insulin to allow fuel utilization

JDRF PEAK
T1D Performance in Exercise and Knowledge

Lucy

- What eating/nutrition strategies might you suggest?
  - Consider body composition and possible need to counsel impact of increasing muscle mass
  - Pre- and post-exercise carbohydrate and protein, bedtime carbohydrate and protein to help reduce hypo risk
  - Protein distribution, no increased requirements due to endurance exercise (1.2 g/kg BW)
  - Ensure that foods are not contributing to excessive energy intake through fat content
  - Fluid advice to ensure adequate fluid intake across day — could be impacting on fatigue if dehydrated
- What other aspects of Lucy's health might you want to explore?
  - BMI 18.9 kg/m^2 (Losing weight or maintaining weight?)
  - Body image
  - BGLs over night — consider CGM

Group Exercise Pediatric Case — Tom

Scenario

- Tom is 15 years old and has type 1 diabetes. He is a junior triathlete, entering his first regional competition
- He has come to you for advice about nutrition to improve his performance
- He currently trains 6 times a week and works as a lifeguard at a local pool on Saturdays
- His typical week includes 2 swim training sessions at 6am before school, 1 swim training session after school from 7–9pm, 2 running sessions in the evenings and 1 cycling session. He also cycles to school on a daily basis (25 minute ride)
- He is managed on MDI and reports eating around 275 g carbohydrate a day. He wants to improve his performance, reduce the number of hypos he experiences both when training and overnight, and increase his muscle mass and strength
- Tom weighs 58 kg and is 5'8", his HbA_{1c} is 6.9% (52 mmol/mol) and current TDD 35 U insulin/day taken as 20 U long acting-analog at night (around 10pm) and 1 U for 10 g carb at meals. Insulin is injected before eating and he reduces his insulin before some training sessions. He does not take insulin with snacks

JDRF PEAK
T1D Performance in Exercise and Knowledge

Tom

Questions

- How would you calculate Tom's energy, carbohydrate and protein requirements?
- How much carbohydrate would you suggest Tom have in a day?
- When should he be eating?
- What advice would you give about protein intake?

Tom

Additional questions

- If Tom asks about protein and creatine supplements, what advice should you give?
- How would you calculate energy needs and carb requirements for actual training sessions?

Tom

- How would you calculate Tom's energy, carbohydrate and protein requirements?
  - Use either a predictive formula e.g. Schofield Height and weight or tables of energy values
  - Approximately 14,000-15,000 kJ/day
  - Assess exercise energy needs using METs for each training session and calculate 50-55% energy as carbohydrate
  - Consider using carbohydrate requirements for sport 6-10 g carbohydrate/day
  - Protein 120 g/day (2g/kg BW) – 160g/day (based on 20% energy from CHO)
- How much carbohydrate would you suggest Tom has a day?
  - Tom ends up eating 400-450 g/day

Tom

- When he should be eating?
  - Distributed across the day, most CHO at meals (approx 90-110 g at meals), at least 60-70 g CHO in meal before and after exercise
- What advice would you give about protein intake?
  - Use high-quality protein food and fluid; distribute across day; Include protein with meals pre- and post-exercise; supplements not needed; if eating enough and glycemia optimized then protein used for tissue accretion and growth

Tom

Additional questions

- If Tom asks about protein and creatine supplements, what advice should you give?
  - Creatine — under 18 so cannot advise on creatine — evidence exists for specific types of sports training. No data in type 1 diabetes on safety or efficacy
  - Protein can be met with food, milk is the most effective way to meet protein needs. Can discuss broadly protein supplements — have CHO and protein mixed. General principle — not above 25 g protein/supp

- How would you calculate carb requirements for actual sessions?
  - At least 60-70 g CHO in meal before exercise
  - 30-60 g CHO/hr during activity for fuel
  - After exercise 60 g CHO – can be distributed over 1-2 hours after exercise. 15-30g in first hour. Add 20-30 g protein
  - Note difference for Fuel Performance versus need to treat hypoglycemia

Summary

- Sports nutrition principles can be adapted for type 1 diabetes
- Consideration of the timing and distribution of nutrients needs to link to insulin adjustment and blood glucose monitoring
- Nutrition advice should consider
  - Habitual diet
  - Pre, during and post exercise nutrition
  - Hydration
  - Promoting healthy balanced diet according to individual need

JDRF PEAK T1D Performance in Exercise and Knowledge

Questions?

JDRF PEAK
T1D Performance in Exercise and Knowledge

THANK YOU!

www.TypeOneNation.org/PEAK

JDRF PEAK T1D Performance in Exercise and Knowledge