

# Endurance Nutrition

## Debunking Myths

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# My Background



- Accredited Practising Sports Dietitian (B.Nut.Diet)
- Specialist in Gastrointestinal Nutrition
- ISAK Level II Accreditation – Skinfolds
  
- Ultra Trail Runner 1<sup>st</sup> Female, 4<sup>th</sup> overall You Yangs 50km 2010 4:28; 7<sup>th</sup> Female, 53 overall North Face 100km 2011; PB Marathon Melbourne 2007 2:56
- Trained in Iten, Kenya and Boulder, Colorado
  
- Continue to work with AIS to help optimise my race nutrition





# Outline

- *“Carbohydrates are fattening!”... “Aren’t they?”*
- *“You should eat the same amount of carbohydrate for every training session.” “Shouldn’t you?”*
- *“Carb loading is going to the bakery filling up on pastrys, oh and eating pizza and pasta with lots of cheese and with garlic bread”... “Isn’t it?”*





# Outline

- *“Protein in sports drink improves endurance performance!” “Doesn’t it?”*
- *“Caffeine dehydrates you!” “Or does it? And can it benefit your endurance performance?”*
- *“You need magnesium for muscle cramps!” “Or do you?”*



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***“Carbohydrates are  
fattening!”...***

***“Aren’t they?”***



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## Carbohydrates

- Premium fuel for endurance sport
- Stored as glycogen in muscle and liver, converted to glucose for exercising muscle
- Inadequate intake could mean “hitting the wall”, fatigue or delayed recovery
- Intensity and duration will influence the amount required



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***“You should eat the same amount of carbohydrate for every training session”...  
“Shouldn’t you?”***





## ***Carbohydrate needs***

- Determined by how much your muscles require – the amount you need to fuel your daily training and to restore your muscle glycogen levels
- Influenced by daily training and size of muscles
- Guidelines for athletes provide an estimate based on body size. Need to be fine tuned based on individual feedback







## Carbohydrate needs Source: Burke and Cox 2010

Activity – daily needs for fuel and recovery	Carbohydrate per kg athlete's body weight (BW)
Light training – low intensity or primarily skill focused	3-5g / kg BW / day
Moderate exercise program e.g. 1hr / day	5-7g / kg BW / day
Endurance program – e.g. 1-3hr / day of moderate to high intensity exercise	6-10g / kg BW / day
Very high level of exercise – e.g. >4-5hr / day of moderate to high intensity exercise, like Tour de France	10-12g / kg BW / day
Maximal. Post event recovery or carbohydrate loading before an event	7-12g / kg BW / for each 24hrs
Speedy. <8hrs between two demanding training sessions	1-1.2g / kg BW immediately after first session. Repeat each hr until normal meal routine occurs



## Periodising Nutrition

- Daily carbohydrate needs vary depending on training demands.
- Train low, compete high
- Training with low carbohydrate availability to enhance training response and then competing with high carbohydrate/fuel availability to promote performance
- Enhanced metabolic adaptations due to training response, increased ability to use fat as exercise fuel, less dependence on carbohydrate





## Periodising Nutrition

- Studies have supported findings

### HOWEVER

- NO CLEAR EVIDENCE showing a performance gain
- Need to be mindful that training low reduces ability to train -  
↑perception of effort and reduced power outputs



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***“Carb loading is going to the bakery filling up on pastrys, oh and eating pizza and pasta with lots of cheese and with garlic bread”... “Isn’t it?”***





## ***Carbo-loading***

- Do you need to do it? Why?
- Endurance sports - **over 90 minutes, continuous, high intensity activity, using same muscle groups**
- Challenge capacity of normal fuel stores
- Prolongs the time race pace or working hard can be maintained, helps delay fatigue. Finish faster





## Carbohydrate Loading

- *What is it?*
- To maximise or super saturate your muscle glycogen stores before a race that would otherwise deplete fuel reserves
- Modified loading strategy
- 1-3 d protocol, 7-12 g CHO/ kg BW / day and exercise taper





## Carbohydrate Loading

- Weight gain 1 - 2 kg – DON'T WORRY!
- This is your energy fuel for the race!
- Normal weight will return after race





## Carbohydrate Loading – so what do athletes do wrong?

- Eat large amounts of non-carbohydrate foods at meals which leads to limited room for carbohydrate rich foods
- Junk foods are good carbohydrate foods e.g. take-aways, chocolate, cream and rich desserts
- Choose meals where they see main ingredient being carbohydrate rich but forget about the other ingredients which are primarily rich in oil, fat or protein e.g. cheese and meat based lasagne







## Carbohydrate Loading – so what do athletes do wrong?

- Maintain everyday healthy eating e.g. avoiding foods with added sugar, eating high fibre foods
- Do not consider high carbohydrate compact foods and fluids





## Carbohydrate Loading Plan

Body weight (BW) : 46 kg

Carbohydrate Intake : 460 g CHO (10 g / kg BW)

- **B/fast:** 2 weetbix + banana + 2 tsp sugar with 1/2 cup low fat milk, 400 ml sports drink
- **Snack:** 1 x sports bar (high CHO)
- **Lunch:** 1 x large roll with jam / honey + 200 ml sports drink
- **Snack:** 250 ml low fat milk drink
- **Dinner:** 3 cups cooked pasta + Tomato based sauce
- **Snack:** 1 x Rice pudding





## Carbohydrate Loading Plan

Body weight (BW) 65kg

Carbohydrate Intake: 650 g CHO (10 g / kg BW)

- **Bkfast:** 2 cups low fibre cereal + 3/4 cup low fat milk, 2 sl low fibre toast with honey, 250 ml orange juice
- **Snack:** 1 x low fat fruit bun + 600 ml sports drink
- **Lunch:** 1 x large roll with low fat fillings + 200 g yoghurt
- **Snack:** 600 ml sports drink
- **Dinner:** 1.5 cups cooked rice, ½ c tomato based sauce + 600 ml soft drink
- **Snack:** 2 x low fat muesli bars + 250 ml liquid meal supplement e.g. Sustagen
- **Throughout day:** 100 g confectionery





## Carbohydrate Loading

- Low fibre, suggest at least the 1 day prior to event
- Want to go in feeling good and light, not full and bloated
- If you want to see the benefits of carbo-loading you need to do it right!
- Haphazard eating and pigging out, will not achieve your carbo-loading goals. Planning and preparation will!



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***“Protein in sports drink improves  
endurance performance!”...  
“Doesn’t it?”***





## Is there a role for protein during exercise?

- Adding protein to carbohydrate drinks
- Small amount of studies showing endurance capacity (time to exhaustion) improved

### **HOWEVER**

- Performance tests not suitable, untrained subjects, diet not carefully controlled, exercise tests not ideal
- Same authors who found a benefit, repeated study found no effect on performance
- Other well-controlled studies found no benefit to performance





***“Caffeine dehydrates you!”...***

***“Or does it? And can it  
benefit your endurance  
performance?”***





## Caffeine

- Allowed in competitive sport
- Naturally occurring stimulant, comes from methylxanthine family. Found in leaves, nuts and seeds of a number of plants
- Major dietary sources: tea, coffee, chocolate, cola and energy drinks
- Provide ~30-200 mg caffeine / per serve
- No-Doz 100 mg caffeine / per tablet







## Caffeine dose

- Plenty of evidence showing caffeine enhances endurance and performance in a range of exercise protocols
- Altered perception of fatigue and effort or effects on muscle
- For events lasting >1 hr or longer, benefits occur at dose 1-3 mg / kg BW
- Does not appear to be further benefit from higher doses





## Timing of Intake

- Absorbed rapidly
- Peak concentration in blood within 1 hr after ingestion
- Slowly broken down, half-life 4-6 hrs. Benefit may last for up to 6 hrs post ingestion
- Traditional approach is to consume caffeine 1 hr prior to exercise. Benefits found also with spread of caffeine intake during exercise





## Caffeine source

- Coffee versus pure caffeine source
- Coffee shown endurance performance benefits but also no detectable effect
- Caffeine has shown increase benefit over coffee
- Caffeine content ranges in coffee. Depends on coffee bean, preparation of coffee
- Single espresso varied from 25 – 214 mg / serve





## “Coca-Cola always the one, whenever”...

- Often see athletes consuming coca-cola in events, especially during latter parts of event
- Aid stations often stock coca-cola

*Is there a reason or is it just another sports nutrition fad?*





## “Coca-Cola always the one, whenever”...

### *Is there a reason or is it just another sports nutrition fad?*

- A series of studies from AIS by Greg Cox *et al* found coca-cola to have a beneficial endurance performance effect over placebo, sports drink, caffeinated beverage
- Effect due to both caffeine and carbohydrate content
- This shows very small amounts of caffeine can be beneficial, there is an added effect of caffeine and carbohydrate
- Beneficial when athlete becomes fatigued





## Caffeine content in various food, supplement sources

Source	Serve	Caffeine (mg)
Instant coffee	250 ml	60* (12 – 169)
Brewed coffee	250 ml	80* (40 – 110)
Espresso	1 shot	107* (25 – 214)
Tea	250 ml	27* (9 – 51)
Coca-Cola	375 ml	49
Red Bull Energy Drink	250 ml	80
PowerBar caffeinated sports gel	1 gel	25
PowerBar caffeinate sports bar	1 bar	50
NoDoz	1 tablet	100

\* = varies depending on brand of coffee/tea, preparation methods

Source: Burke and Cox 2010





## Caffeine responders and non-responders.

### *“Isn’t caffeine a diuretic?”*

- Individual effect
- Non-responders and responders
- Negative effects
- Caffeine does not tend to dehydrate you, its effect as a diuretic is overstated and is likely minimal. Can contribute towards your fluid intake



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***“You need magnesium for muscle cramps!”...***

***“Or do you?”***







## What causes muscle cramps?

- Million dollar question, nobody really knows
- 2 out of 3 athletes experience cramp
- Commonly occurs in calf muscle or foot. Can occur more frequently with age
- Dehydration and/or lack of sodium has been associated with onset of muscle cramp. No evidence magnesium causes muscle cramps
- Other suspected causes: over exertion or poor blood supply to the muscle





## What causes muscle cramps?

- Heavy sweat losses can cause significant salt (sodium) losses from the body. This can trigger a cramp if sodium is not replaced
- Brett Lee – sweat is high in sodium, 1300mg / L . Imagine this over 6 hrs of cricket
- He often suffered cramp in last part of play, since replacing his sodium with replacement supplement (Gator Lyte) no longer a problem





## How do you avoid muscle cramps?

- Limit dehydration. Develop and use your fluid plan – more on this soon
- Work out if you are a salty sweater. May need a sports drink to help replace sodium lost in sweat or if ultra endurance event more focused sodium replacement – more on this soon
- Meal following exercise will help replace sodium losses
- Train those muscles. Cramps - less common in well trained athletes





## How do you avoid muscle cramps?

- Stretch before and after exercise
- Wear loose clothing. If tight may reduce blood flow to muscles, more susceptible to cramps
- Acclimitise to environment





## Fluids

- Preventing dehydration is key to helping you sustain performance
- Fluid loss – variable
- Depends on climate, altitude, individual athlete, training intensity
- Practise your hydration strategy during training to help determine your optimal fluid intake and to minimise gastrointestinal discomfort
- Monitor sweat rate: weight pre and post training





## How can you monitoring your sweat losses?

- Weight before session, after going to toilet (kg)
- Wear minimal clothing
- Weight after session, in same clothes, towel dried (kg)
- If peed during the session, need to weigh in prior and post
- Weigh drink bottle prior and post session. Or estimate fluid consumed – convert ml to grams





## Monitoring Sweat Losses

- Fluid intake (ml) – drink bottle prior & post session (g) =  
 $600 - 300 = 300 \text{ g or } 300 \text{ ml}$
- Urine loss (ml) – weight prior & post loo stop (kg) x 1000 =  
 $65.25 - 65.00 = 0.25 \text{ kg} = 250 \text{ ml}$
- Fluid deficit (dehydration) (ml) – weight prior & post workout (kg) x  
1000 =  
 $65.50 - 64.50 = 1 \text{ kg} = 1000 \text{ ml}$





## Monitoring Sweat Losses

- Fluid deficit (% body weight) =  $100 \times \text{fluid deficit (kg)} / \text{BW (kg)} = 100 \times 1.0 / 65.50 = 1.5 \%$
- Total sweat loss over session – fluid deficit (g) + fluid intake (g) – urine losses (g) –  $1000 \text{ g} + 300 - 250 = 1050 \text{ ml}$
- Sweat rate over session – sweat losses converted to ml per hour after training
- 90min session – sweat rate =  $1050 / 90 \times 60 = 700 \text{ ml} / \text{hr}$







## How much should I drink during?

- No “one size fits all” approach
- You need to learn what your fluid/sweat losses are and develop an individualised **plan** appropriate to the event
- Consider the training or event you are participating in, whether a hydration plan is needed.
- **Practice, practice, practice** in training, gut tolerability
- Generally aiming for your fluid deficit < 2 % of body weight. Particularly important in hot environment





## What about fluid plan for an ultra event?

- Sports drinks generally meet requirements for average sporting event
- Some athletes may need to modify standard sports drink to help meet needs for their event

### 1-3hr event

- Prolonged event, cold environment – may place greater concern on fuel (carbohydrate) needs, more concentrated sports drink
- Prolonged event, hot environment – may place greater concern on fluid needs, more dilute sports drink. Since you'll be consuming more fluid your carbohydrate intake will also be naturally bumped up





## What about fluid plan for an ultra event? Cont.

Events >3 hrs duration – fluid + carbohydrate + sodium needed

- Plan to replace sodium through fluid and foods
- Should not drink fluid in amounts that cause athlete to gain weight
- Loss of 1-2 % body weight probable due to factors other than sweat loss e.g. metabolic fuel loss
- Sodium amount – optimal amount not known





## What about fluid plan for an ultra event? Cont.

- Sweat contains ~50 mmol / L sodium, vary between 20-80 mmol / L
- Sports drinks 10-25 mmol / L sodium
- Suggest replace ~30 mmol sodium / hr
  
- 23 mg sodium = 1 mmol sodium
- 58 mg salt (NaCl) = 1 mmol sodium





## What about fluid plan for an ultra event? Cont.

- Consume some higher sodium beverages and foods during the race
- Typical fuel sources: gels, sports drinks, coca-cola – **low sodium**



## What about fluid plan for an ultra event? Cont.

FUEL SOURCE	SODIUM CONTENT (mmol)
Vegemite sandwich (white bread, no crust, 1tsp vegemite)	26 mmol +24 g carbohydrate
Potato Crisps (100 g)	25mmol
Gator Lyte, sachet	34 mmol (780 mg sodium)
Gastrolyte (made to full strength, 5 sachets to 1000ml water)	60 mmol
Salt Tablet e.g. Saltadex	7 mmol (420 mg salt)
Massel's Chicken Stock 1 cube	16 mmol (388 mg salt)





## Fluids - Recovery

- Aim to replace 125-150% fluid loss asap over 4-6hrs post
- On any training day drink enough to allow for pale urine 5-6xday
- Consuming a sodium containing drink (sports drink) or water with food (sodium) can help enhance fluid absorption
- Start training/game well hydrated
- Drink to a plan throughout the day. Always have drink bottles handy. Keep fluids cool with ice or freeze night before allowing them to defrost slowly over the day





## Sports Drink

- Convenient way to replace fluid and carbohydrate
- Help restore electrolytes (10-25mmol/L sodium)
- Salt helps increase fluid intake







## How often should you drink to replace fluid during recovery?

- In general best to spread fluid intake over recovery period
- Prevent it jumping around, uncomfortable and making funny embarrassing sounds in gut
- Minimises urine lost – retain more fluid





## Summing Up

- Carbohydrates aren't fattening. You just need to know how to incorporate them into your nutrition plan.
- You shouldn't eat the same amount of carbohydrate for every training session. Your nutrition plan should be periodised.
- Carb loading is not about going to the bakery filling up on pastries, eating pizza and pasta with lots of cheese and with garlic bread. You'll just feel bloated and get a tummy doing this.





## Summing Up

- Protein in sports drink has not been shown to improve endurance performance.
- Caffeine can help towards your hydration more so than dehydrating you. It may benefit your endurance performance, provided you are a responder and use protocol.
- Magnesium has not been shown to cause muscle cramps.





# More Information

- Nutrition consult: Optimal Endurance Nutrition
- T: 8165 0606 M: 0417 122 070
- [www.optimalendurancenutrition.com](http://www.optimalendurancenutrition.com)
- [steph@optimalendurancenutrition.com](mailto:steph@optimalendurancenutrition.com)
- See [www.sportsdietitians.com](http://www.sportsdietitians.com) for articles and general fact sheets



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# Cooking Classes for Sports Nutrition

- Contact Mel Hayes 0409 108 175  
[mel@nutrition.edu.au](mailto:mel@nutrition.edu.au)



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# Thank You!



*Optimise nutrition to optimise your performance.*

