Running water: how much do athletes need to drink?

JAMES LAWRENCE BMedSci, BM BS, FACSP

Drinking is one of our most basic and essential functions, but when and what should we be drinking when we exercise?

Optimising fluid balance in athletes is considered to be an important part of maintaining performance and avoiding the deleterious effects of under- and over-hydration. So it is perhaps surprising to note the widely conflicting and varied opinions on how best to replace fluids during exercise. Professional and elite athletes may have coaches and sports science teams that monitor their hydration status and provide guidance. However, recreational and amateur athletes, who represent a much larger group, obtain their information about fluid and electrolyte replacement from a variety of sources, including sports drink manufacturers. For some individuals, hydration may not be an aspect of training or performance that has been considered at all.

MedicineToday 2016; 17(7): 59-61

Dr Lawrence is a Sports and Exercise Physician at North Sydney Sports Medicine Centre, Sydney. He is a team doctor with Sydney FC and has worked as part of the high-performance team with Rowing Australia, Paralympic Winter Sport and the GWS Giants AFL team.
SERIES EDITOR: Dr Seamus Dalton, MB BS, FAFRM, FACSP, Consultant Physician in Rehabilitation and Sports and Exercise Medicine, North Sydney Sports Medicine Centre, Sydney, NSW.

Drinking practices among recreational athletes vary widely, and even some people who run marathons lack knowledge about appropriate hydration strategies.[1] Therefore, hydration in exercise is a topic where opportunistic advice from medical practitioners, together with more general ongoing education from sporting organisations, can have a positive impact.

Exercise and fluid replacement

During exercise, athletes can lose up to two litres of sweat per hour. This fluid loss, together with peripheral vasodilation and the diversion of blood to supply working muscles, can lead to a relative hypovolaemia and negatively impact on exercise capacity and thermoregulation. Evaporation of sweat is the primary method by which the exercising body disperses heat, and therefore the ability to generate sweat is a critical function. Replacing lost fluid is important, particularly in the context of longer-duration exercise (more than one hour) and in warmer environmental conditions.

Historically, scientific opinion has been split on the topic of fluid replacement, with different professional groups arguing for and against maximising fluid intake during exercise. Position statements have been conflicting, but over the years these have been modified to align with the generally recognised advice (and common sense approach) of 'drink to thirst'.[2-4]

The equivocal nature of the advice borne out of the early literature on fluid replacement has, however, provided fertile ground for those with a vested interest. Sports drink manufacturers dominate advertising around sporting events, and their marketing methods detail the specific electrolyte contents and osmolality of their products. These companies are now closely integrated with sporting institutes worldwide, and people could be forgiven for thinking they need to replenish their sodium, potassium and magnesium after a jog around the local park. It is not that sports drinks are not useful for replenishing fluid in the right context, but for the majority of recreational exercisers they are not a mandatory requirement. The jury is still out as to whether they provide any meaningful performance benefit over

1. HYDRATION IN EXERCISE: A PRACTICAL GUIDE FOR RECREATIONAL ATHLETES

Pre-exercise
To optimise performance, athletes should ensure they are well hydrated before exercise, drinking enough in the hours before exercise to ensure their urine is pale yellow.

Drinking up to 500 mL about 30 to 60 minutes before exercising should be sufficient, unless an athlete is particularly dehydrated beforehand. Excessive fluid intake just prior to exercise can lead to abdominal discomfort.

During exercise
For exercise of less than one hour in duration:
Drinking during exercise is usually unnecessary unless the environment is particularly hot. Drink to thirst.

For exercise of one to two hours in duration and continuous:
Fluid replacement will probably be necessary. Some carbohydrate (30 to 60 g/hour) can also help to maintain performance. Examples include plain water, plain water with food (e.g. banana, other fruit, cereal bar or sports gel) or a sports drink (which typically contain 6 to 8% carbohydrate or approximately 40 g/600 mL). Drink to thirst.

For exercise of more than two hours in duration (endurance exercise):
Fluid replacement will be necessary, as guided by thirst. Carbohydrate and electrolytes should also be replaced to optimise performance. Examples include water with food and/or with sports gels or a sports drink. Athletes should be guided by what is palatable. If feeling bloated/full then fluid intake should be reduced. In hot conditions fluid requirements will be higher but using a set volume/hour is not recommended.

Post-exercise
Athletes should rehydrate over a few hours until passing pale urine.

If body weight measurements are being used (i.e. body weight before and after exercise) then requirements can be estimated to be 125 to 150% of losses. For example, if weight loss is 2 kg, then appropriate fluid replacement is up to 3 L (2 kg x 150% = 3 L) over a period of a few hours. Fluid replacement should primarily be water, but if exercise has been of long duration then some carbohydrate in the first one to two hours post-activity helps to replenish muscle and liver glycogen stores.

2. PRACTICE POINTS

- Optimising fluid balance in athletes is considered to be an important part of maintaining performance and avoiding mal-hydration.
- For exercise of less than one hour in duration, water is all that is required for hydration. Fluid replacement may not be needed during the activity.
- Exercise-associated hyponatraemia can be fatal if not recognised and appropriately treated. However, the condition is essentially preventable with appropriate education about the dangers of over-drinking.
- Most recreational runners and other athletes are able to self-regulate their fluid intake. For this group, the safest and most appropriate general advice is to drink to thirst. Strict drinking practices that focus on specified amounts of liquid replacement are not advisable.
- Monitoring body weight before and after exercise can provide useful information about fluid losses. Any gain in body weight implies over-drinking, whereas a loss of 2 to 3% body weight is acceptable.

water, and there are potential hazards related to excessive carbohydrate intake including tooth decay and, ironically, obesity. Ultimately, what people drink is less important than how much they drink.

What are the implications of mal-hydration?

For exercise duration of an hour or less, an individual will not become significantly dehydrated even in extreme conditions. However, if fluid losses are high, due to prolonged exercise (more than one to two hours) in a hot environment, and fluid replacement is inadequate then the development of severe dehydration and heat illness is a legitimate concern. This can lead to a spectrum of presentations, including reduced performance, postural hypotension, rhabdomyolysis, acute renal failure, confusion and, in extreme situations, hyperthermia and collapse requiring emergency medical care.

There is general consensus that when thirst alone is relied on to guide fluid replacement then people replenish only about 75% of their fluid loss. This realisation prompted early hydration guidelines, notably from the American College of Sports Medicine, to recommend drinking 'as much as tolerable' during endurance events;[2] this recommendation has since been changed.[3] The risk of this greater intake over a short period of time is minimal, but during an endurance event (more than two hours' duration) there is a danger of exercise-associated hyponatraemia (EAH) or dilutional hyponatraemia. The aetiology is primarily related to over-consumption of fluid, although the involvement of excessive secretion of antidiuretic hormone is increasingly being recognised.[5]

Numerous fatalities as a result of EAH have been reported during endurance events, and the incidence of asymptomatic hyponatraemia in marathon runners has been found to range between 3% and 12.5%.[6-8] Symptoms of EAH can be nonspecific, ranging from bloating and headache, through to confusion, ataxia and coma from cerebral oedema. However, the condition is essentially preventable with appropriate education about the dangers of over-drinking, whether that be water or sports drinks. Over-hydration is far less common than dehydration in athletes but it is more dangerous.

What factors affect fluid requirements?

Numerous factors influence an individual's fluid requirements during training and competition. These include body mass, sweat rates, environmental conditions, intensity and duration of exercise, clothing and altitude, as well as any medical problems or medications. People seem to differ in their ability to tolerate dehydration and changes in core temperature without adverse consequences. Laboratory studies suggest that losing more than 2 to 3% of body weight during exercise (representing a dehydrated state) impacts negatively on exercise capacity and ability to thermoregulate.[9] However, the fastest marathon times are generally demonstrated in athletes that lose more body weight during the run – this is typically a loss of 3 to 4% but in some instances up to 10%.[10] It is difficult to rationalise these inconsistencies other than by accepting that individuals have significantly different fluid needs and that these needs vary in different environmental conditions.

What does this mean for the average recreational athlete?

Despite much theoretical argument based on the extremes of drinking too much or too little, the vast majority of recreational runners and other athletes are able to self-regulate their fluid intake. The take-home message for this group of people is to not rely on overly strict drinking practices that focus on specified amounts of liquid replacement. This is a 'fluid' situation (pun intended), and the safest and most appropriate general advice is to drink to thirst.

Individuals who are particularly focused on their hydration strategy need to practise this and develop an understanding of how their fluid requirements change in different conditions. Monitoring body weight before and after exercise can provide useful information (minimal clothing and dry skin is important to control for sweat). Any gain in body weight implies over-drinking, whereas a loss of 2 to 3% body weight is acceptable.

A practical guide to maintaining appropriate hydration in recreational athletes is given in Box 1. Practice points regarding the management of hydration in athletes are listed in Box 2.

Conclusion

The longer the duration of exercise, the greater the potential for mal-hydration. For elite athletes, hydration strategies need to be individualised to optimise fluid balance and carbohydrate intake. For the general exercising population, there is much conflicting (and often biased) advice available regarding hydration in exercise. Comparing measurements of body weight before and after exercise can guide fluid intake, but this strategy requires practise. If an athlete has any doubt about appropriate hydration using this method then they would be best advised to 'drink to thirst'; a small degree of dehydration will not impact significantly on performance. Education about the risks of over-drinking during endurance events is important, particularly for relatively inexperienced participants. EAH can be fatal if not recognised and appropriately treated. Some carbohydrate intake with exercise of more than one hour in duration is usually beneficial – individuals should eat or drink whatever they find most palatable during exercise, and be guided by thirst for hydration. MT

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COMPETING INTERESTS: None.

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