Hydration and Hyponatremia (low blood plasma sodium concentration)

How much should I drink?

Do you think that I am going to provide you with an actual amount...? Nope sorry, I don’t believe that is good practice as this would be generalising fluid needs and fluid needs are INDIVIDUAL!

Here is my feedback about hydration based on the literature I have read so far, much taken from Timothy D Noake (author of ‘Lore of Running’), Jonathan P Dugas and Eric D B Goulet’s work.

Some of you may have read or heard the following:

- ‘dehydration can impair exercise performance’

You may have even read the 2010 International Olympic Committee position statement which recommends the following for athletes:

- ‘limit dehydration to <2 % body weight’

Research that supports the latter statement in particular has not considered real life exercise scenarios.

Dehydration can impair exercise performance but by how much is debatable. Dehydration effects individuals to different levels, some may tolerate dehydration better than others. It is often claimed that dehydration of as little as 1–3 % can influence a performance decrement of 20-50 %. However a study by Dugas et al 2009 using a real life exercise scenario showed study participants who experienced a level of 2 % dehydration experienced an impaired performance of 1.3 %. This is a substantially smaller amount than the 20-50 % often mentioned.

Many studies have used time to exhaustion (TTE) exercise – this is not a real life exercise scenario, study designs may not have considered convective cooling effects and or studies have compared deliberate drinking to prevent weight loss from sweat against no fluid available at all, again this is not a real life exercise scenario. In self-paced, fixed distance or duration events that mimic real life competition there is only one intervention study that I am aware of that has investigated the effect of various levels of fluid intake on performance. This study is by Dugas et al 2009. The study compared the effects of graded fluid replacement on thermoregulation and cycling performance in hot (33 °C) and humid (50%) conditions. Six highly trained male cyclists (23 ± 4 years) performed six 80km time trials where they replaced:

1. 0 %
2. 33 %
3. 66 %
4. 100 % weight lost with fluid or
5. Carried out mouth rinses at 10km intervals or
6. drank Ad libitum (according to thirst)
Furthermore a recent meta-analysis reported:

‘Exercise induced dehydration (EID) <4% body weight does not impair exercise performance during exercise that simulates real world exercise conditions’ (Goulet, 2012)

Drinking to thirst is supported by the International Marathon Medical Directors Association and also the Exercise Associated Hyponatremia (EAH) consensus statement. We will discuss the latter soon.

**So what are my guidelines for fluid intake, keeping in mind as research continues my suggestions may change?**

...drink to Ad libitum – according to dictates of thirst

...may do fluid assessment and then look at replacing approximately 50 - 55% of sweat loss

...be careful not to overhydrate!

...further research that simulates real life exercise scenarios of athletes is required

...ingesting fluid regularly rather than infrequent large bolus’ amounts will assist with gastric emptying therefore I suggest consuming fluid at regular intervals

**Fluid assessment**

You can estimate your approximate fluid loss in different environments by the following:

1. weigh yourself pre & post exercise  (weight pre - weight post = net loss kg = L)
2. monitor fluid consumption, L consumed
3. net loss (L) + fluid consumed (L) / time (h) = sweat rate (L / h)
4. weight lost kg / weight before kg = % dehydration

*The assessment of exercise induced dehydration using the above is an estimate only it lacks precision. It’s the most practical method to provide an estimate for field conditions.*
**Is it possible to drink too much?**

Yes! **And it could be harmful!**

**Exercise Associated Hyponatremia (EAH)**

Exercise associated hyponatremia (EAH) is the occurrence of hyponatremia during or up to 24 hours after long duration exercise. It is a serum or plasma sodium concentration below the normal reference range of the testing laboratory. Usually this level is a sodium concentration < 135 mmol/L (Hew-Butler *et al* 2008). It occurs in predisposed individuals when they ingest fluid to excess during prolonged exercise, usually more than 4hrs (Noakes, 2012).

If weight post event is greater than your weight pre-event, you are likely consuming excess fluid. Keep in mind though that EAH can still occur without a gain of body weight this is because body weight change is not only related to fluid loss but reflects fuel utilisation.

I am not aware of evidence that a sodium deficiency contributes to development of EAH. There is no significant difference in sodium loss in those that develop EAH compared to those that don’t.

EAH can not occur if the individual doesn’t have syndrome of inappropriate antidiuretic hormone secretion (SIADH). The other factor that needs to be present in order for EAH to occur is poor mobilisation of non-osmotically active sodium stores.

The most effective way to prevent EAH is to make sure predisposed individuals do not overdrink during prolonged exercise (Noakes, 2012). The Second International Exercise-Associated Hyponatremia (EAH) Consensus statement recommends the following to help prevent against EAH:

> ‘Avoid over consumption of fluids before, during and after exercise...the goal should be to expect to lose up to two percent of body weight and never to gain weight during exercise.’ (Hew-Butler *et al* 2008, p.114)

The statement suggests two ways to help prevent against fluid retention:

1. **drink according to thirst (Ad libitum)**
2. **monitor body weight in order to avoid weight gain during exercise**

**What If I drink sports drink can this help prevent against EAH?**

Ingesting electrolyte-containing sports drinks can not prevent EAH development in athletes who drink to excess. These drinks contain sodium <135 mmol/L and therefore cause a dilution of blood sodium concentration.

**What do race organisers need to do to help prevent against EAH?**

Athletes should be advised on the risks of overdrinking and events should limit fluid availability. If this is done it has been associated with a reduction in the incidence of EAH without harmful effect.
Fluid stations should be every 20km in cycle leg of Ironman triathlon and 2.5km for the run leg. In a marathon every 5km. Providing advice alone about good drinking behaviour in an ultra marathon has been associated with minimising the incidence of EAH (Hew-Butler et al 2008).

**Who is at risk of EAH? What events increase risk of EAH?**

EAH is more common in the following athletes:

- female runners
- slower paced athletes
- event inexperience of athlete
- NSAID use by athlete
- athletes with low body weight
- athletes who gain weight
- athletes who display excessive drinking characteristics

It is more likely in the following events:

- High fluid availability
- >4hr event
- Unusually hot conditions
- Extreme cold

**What else should race organisers be aware of regarding EAH?**

For further information on EAH please see the following [link](http://www.overhydration.org/downloads/EAH_Statement_2008.pdf) If you are a race organiser please ensure that you have in place safety measures for treating EAH, see p.114 of the pdf link which discusses treatment protocols of EAH.

A survey of 197 runners found that most (58%) of the runners drank only when thirsty but there was not good knowledge relating to the effects of under and over hydration, EAH and heat stroke. Many runners were unaware of the effects of drinking beyond thirst (Winger et al 2011).

**References**


Noakes TD. Waterlogged The serious problem of overhydration in endurance sports. 2012. Human Kinetics


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