

# Practical Hydration / RE-hydration

## Information for patients

Andrew Cook MSc RCST

Hydration is not just about water. It's about the *water-salt balance* in your body, and also to some extent about body temperature. The adrenal system that we use to release energy seems to have originally evolved to help fishes maintain a proper internal salt-water balance, so hydration is also strongly related to emotional stress and physical activity.

However, hydration is mainly about **WATER**

and ALSO the four major plasma electrolyte salts :

**Sodium (Na)** as found in common table salt Sodium Chloride, plus **Potassium (K)**, **Magnesium (Mg)** and **Calcium (Ca)**.

When we first evolved as single cells floating in the ocean, one function of having a cell wall was to allow us to carry round a small stable ocean environment inside ourselves. Maintaining the stability of this internal ocean is one of the functions called "*homeostasis*", and is vital for life. We can tolerate certain ranges of hydration by drawing water out of fat tissues or storing it in them, and the same goes for major electrolytes. But this adaptation comes at a price – because it places physiological strain on the body.

So "**Dehydration**" in the meaning I am using in this text is actually a *non-ideal internal salt-water balance*. For most people that would mean not enough water, but for someone exercising a lot or on a low salt diet - that might mean not enough salt. And of course, some people are short of BOTH water AND salt... **The low-level symptoms are pretty similar whichever direction this has gone in.** Before you get to extreme dehydration that would require medical attention (a saline drip) you might experience **dehydration symptoms** such as ...

- **Lower back pain/weakness** (this is really common in professions that drink a lot of coffee in the office, or people such as drivers whose work "requires" they drink less so they don't need to pee)
- **Constipation** (which adds to the lower back pain) – or diarrhoea for chronically excess hydration
- **Dull, or tight or fuzzy or throbbing Headaches, dizziness, difficulty thinking**
- **Thick mucous in the mouth and throat**
- **Inexplicable exhaustion** (and there is probably a relationship between dehydration and early-onset diabetes)
- **"Wired and tired"** – including difficulty sleeping
- **Fluid oedema, usually ankles/feet** (and sometimes also wrists/hands - one of the less common causes of "repetitive strain injury" symptoms). Most people think oedema is excess



water, but it can also be caused by (i) osmotic imbalance (i.e. salt is also an issue) or (ii) by insufficient lymphatic activity (one possible cause of which is chronic dehydration) or (iii) by excess release of fluid through the capillary bed (which may also be an osmotic issue – that can e.g. be exacerbated by alcohol intake).

- ...
- **Chronic dehydration can be a major stressor to the body, due to the relationship between water balance and adrenal function.** It might not seem to be very much, but when added to other factors can contribute to relatively minor incidents causing shock and PTSD – instead of them being “cope-able”. Simultaneous {Stress + dehydration} is far more likely to result in overwhelm.
- ...
- And as dehydration gets more severe, there can also be **nausea, general muscle weakness or exhaustion, muscle cramps, gastric disturbances, drying of the mouth and eyes and other mucous membranes, and very frequently tight pounding headaches**

### **Ways “dehydration” (i.e. osmotic imbalance) can happen**

1. **Not enough water = too much salt in the body**, which then leads to water being pulled towards places it is not needed (odema/fluid swelling)
2. **Too much salt = not enough water** (see #1 above) but also will pee a lot to get rid of the salt, further increasing dehydration
3. **Not enough salt = too much water in the body**, which then leads to the body expelling water (which then also can lead to dehydration!!!)
4. **Too much water = not enough salt ...** is quite difficult to achieve, but some people have actually drunk themselves to death on water. This is quite hard to do – you would have to drink 4 or 5 litres a day (or more) for a several weeks. Drinking of lots of ice-cold water is a common obsession seen in people suffering from complex PTSD.
5. Too much of both – see #4
6. Too little of both – see #1

This might sound complicated. And it is if you try to think about it too hard. So I suggest that either you take a Master’s degree in Physiology, OR you just don’t think about it too hard. I have seen a few people who attempted to forcibly re-regulate their electrolyte salt and water balance themselves by taking large quantities of water and potassium or magnesium – come very badly unstuck and make themselves very ill. The fact is that you actually don’t need to worry about it too much beyond a few very simple rules. **If you keep interventions light (i.e. safe), then the body’s homeostatic mechanism will re-regulate itself.**

And if we start to look at diet, lifestyle, exercise nutrition, and try to define an exact dietary requirement for water and different electrolytes, then we find that it varies between individuals and with so many factors (including state of health) that a simple monograph like this is quite inadequate. If you have reached the stage where osmotic imbalances are causing major health (e.g. cardiac/oedema) issues and you have a cabinet full of electrolytes and a fridge full of water bottles, then you need to seek professional help.

## Rehydration RULE #1

Just remember that **your body has a homeostatic intelligence that regulates most of this for you**. All other things being equal, all that's necessary is to get intake roughly right by **drinking when you feel thirsty** and **taking salt when you like the taste of salt**, and your body's homeostatic intelligence will do the rest.

**However**, if you have a chronic (long-term) deficit of water or excess/insufficient intake of salt, or chronic "stress" - then your thirst and salt internal "warning lights" will no longer be properly calibrated. They will only re-set themselves once you have been properly fully hydrated for a few months. So getting from chronically De-hydrated (or even chronically over-hydrated) back to an optimum bodily salt-water balance takes a little effort.

### Q. What does "more water" actually mean?

Hydration is not just about how much you water take in – it's also about how easily available that water is, and how quickly it is leaving again :

- Drinks with sugar or artificial sweeteners (canned/fizzy drinks, fruit juices and fruit teas) or alcohol do NOT hydrate the body very well at all, because the sugars/sweeteners/alcohol compete for the water. A moderate to high intake of sweet foods (including those with artificial sweeteners) or a high intake of salty foods such as crisps can result in effective dehydration because it takes more water for the body to neutralise the osmotic demand of the sugars/salts.
- Drinks with a lot of tannins (black tea, green tea) do NOT hydrate very well because they tend to have a drying effect on the body tissues.
- Drinks containing diuretics (caffeine) such as black/green tea and coffee do NOT hydrate the body very well because they induce a too-rapid loss of fluids and affect adrenal activity.
- If you are sweating heavily through your work or exercise or illness, or because air temperatures are above 25 or 30°C you will need to take in more water and a little salt. If you are using air conditioning or are living in a house that is centrally heated above 21°C you will probably need to take in more water for the same reasons (because of the drying effect of the low air humidity).
- A moderate to high intake of processed savoury foods (crisps, etc) can result in effective dehydration because there is excess salt (Sodium).
- **If you have acute or chronic runny stools or vomiting/diarrhoea, you will definitely need to take more water and salt/dioralite.**

## Dioralite

Proper Dioralite consists of water + Sodium Na (common salt) + Potassium K in a ratio 7Na:1K. Then anything else can be added depending on the purpose. Good quality Dioralites (such as approved by the WHO, or as found in sports drinks) often include glucose, Magnesium, vitamins and may even include omega oils and critical amino acids. Sports Dioralites may also include herbs such as Ginseng or Guarana, trace elements. Dioralites are really meant for extreme cases. Medical dioralites are typically for people who might die due to dehydration from vomitong/diarrhoea. Sports Dioralites are meant for recovery from extreme sweaty exertion. Dioralites should not contain artificial sweeteners!!!!!!

## Rehydration RULE #2

### How do I know if I'm dehydrated?

One simple answer to WATER is to check your urine colour.

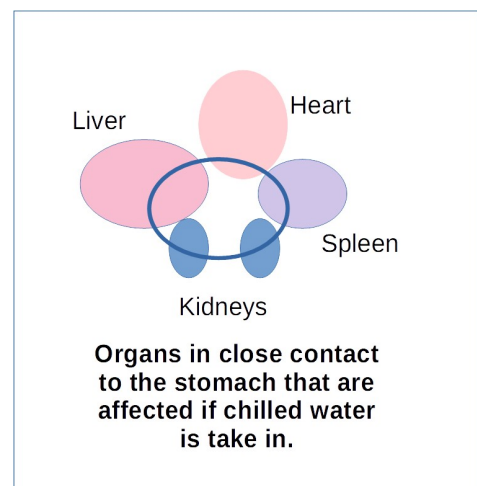
*A basic guideline used by people living in the Australian desert is that – if they are properly hydrated they will “Wee White Once” i.e. will have clear to very pale straw-yellow urine at least once every 24 hours. Urine with a dark almost black appearance is a sign of severe dehydration (or poisoning). Remember that Vitamin B12 and some foods (such as beetroot) will darken your urine.*

Another answer is to check the symptom list above. If you regularly have any of these symptoms, (backpain, headaches, etc.) then you might (simply) be dehydrated. And another answer is that as a very very rough rule, you should be drinking about a litre (or 1 ½ pints) of water a day. If you're drinking a lot less than that (allowing for factors such as exercise etc) or most of your liquids are not plain water, then it's likely you might be dehydrated.

### I like to drink iced water to keep cool – is that OK?

No.

People who work in deserts can tell you that drinking cold water can push the body into shock, or even coma. The stomach is in the core of the body; and core body temperature is critical to within just a few 10th's of a degree. And there are several vital organs around the stomach including the heart – that are chilled if iced water is drunk - in particular, the kidneys and the adrenal glands. Drinking cold water tends to prevent hydration. If you want to be cool in very hot weather, drink air temperature water, wear a hat and occasionally soak it with water to cool your head. Don't drink iced water.



### Hydration/RE-hydration

©Andrew Cook, Norwich (UK) 2021

v. 1.0 last revised 18/02/2022

page 4 of 8

## Rehydration RULE #3

**The best water temperature to drink to RE-hydrate is somewhere between air temperature and body temperature** (or even slightly higher if it's cold).

**i.e. 20 – 45°C**

**For normal hydration water at or slightly lower than air temperature works best.** I would (personally) hardly ever drink iced drinks. They are cooling in hot weather, but continuous use (as has been said previously) is not a good idea.

### **Q. What does it mean if I'm thirsty all the time?**

Excessive thirst can come about through a range of different causes.

**If you're thirsty but don't drink fluids that rehydrate you** (i.e. you drink iced water, or coffee, or sweetened fizzy drinks), **then of course, you will be thirsty** because even though you are drinking, your body is not getting what it needs.

**You can also feel thirsty because you are short of salt(!)** The only way to know this is to have a think about your salt intake. The Romans used to pay people in blocks of salt, because salt is vital for maintaining health – and it was also important for preserving and sterilising food. There has been a medical myth for the past 50 years that too much salt causes high blood pressure. A more useful way to frame that is – **salt is vital for health, but not in excessive quantities!** And *if you already have high blood pressure, eating large quantities* of salt will make it much worse. Processed foods are high in salt, fat and sugar because our bodies have evolved to crave salt, fat and sugar, and so that combination always tastes good – so the problem is usually processed foods, not salt.

**Thirst can result from taking in too much salt** – or swimming in the sea.

**Thirst is a byproduct of taking in too much sugar and therefore having too much sugar in the blood** for a while. Caffeine or nicotine (coffee, smoking) release blood sugar – which is why they give a pleasant “kick”, and which is also why they are addictive drugs. Thirst is also one symptom of diabetes (excess blood sugar), and in this case often also comes with excessively frequent urination. However, just remember the link between hydration, adrenaline, and blood sugar release - this essentially all goes in a big circle. So although drinking water won't cure diabetes, settling into a habit of being properly hydrated is one way to reduce or even prevent the feedback loop that can create mild (early-onset) diabetes.

### **Q. What does it mean if I'm never thirsty?**

Simply, your internal “thirst alarm” has become uncalibrated due to a habit of ignoring it, probably from many years ago. Or you might even have forgotten what that “I'm thirsty” feeling feels like! This might sound strange, but there is a world of difference between an *“I'm thirsty because my mouth is dry, I feel exhausted, my head is pounding and I'm about to faint”*, versus the far more subtle healthy feeling of *“a bit of water might feel nice right now”* - that is the proper way it should work.

## **Q. How do I know if I have enough salt?**

You might think that if you had low salt (electrolytes), that would show up on a blood test. However, blood tests only check *what is in the blood* – i.e. what being transported round the body from one place to another. So they do NOT measure electrolyte concentrations in either the interstitial tissues of the body (in ligaments or bones, and in the abdominal cavity, etc.), or in the various cells of the body and the vital organs. The blood tests will only show a large deficit, when the problem has gone beyond its initial stages and your body's homeostasis is now struggling to adapt. But dehydration starts well before then. If it can be remedied BEFORE the blood plasma levels are affected, you might well have prevented a major illness.

### **How do I know whether I'm short of electrolyte salts?**

If it's badly wrong, it will show up in blood tests. But before then, it's not always possible to know. If you drink lots of water and are still showing dehydration symptoms or are constantly thirsty, then you may be short of electrolytes(!) The same is true if you drink lots but are on a reduced salt diet, and/or sweat a lot or have pain round your kidneys/lower back.

Potassium (K) tends to be lost more easily than Sodium (Na) because it is a smaller molecule, so although the body has a smaller need for Potassium, it is usually better to include some K in any rehydration programme. WHO "Dioralite" rehydration formulae are used for treating extreme dehydration due to dysentery/cholera. They are mainly water, but also contain a foods (such as vitamins, emulsified oils and sugar), and a ratio by weight of 7:1 Sodium:Potassium. If you see a dioralite for sale that does not contain potassium or that contains artificial sweeteners, just don't touch it. I usually recommend the Electrolyte Mix sold online by Bulk Powders ([www.bulk.com](http://www.bulk.com)) - being a combination of Na, K, Mg and Ca as used for rehydration in Sports Medicine. If you have a fairly high dairy (i.e. high Calcium/Ca) diet, then you might be better just taking a little extra Magnesium/Mg.

It's hard to be short of Sodium (Na), unless you're on a low salt diet. But mild potassium deficit is not so uncommon. However supplementing with ONLY Potassium is not a good idea – Potassium and Sodium should be mixed. The only reason Potassium is not in common table salt is that it is "hydrophilic" – i.e. the salt attracts water and turns to mush.

## **Rehydration RULE #4**

### **Rehydration means getting the salt-water balance correct.**

It's actually hard to tell what has gone on, and how your body might have adapted to various shortages of water and/or salt.

So I recommend that rehydration consists of drinking warm water with a **tiny** bit of salt – or having slightly saltier meals. With the proviso that the "salt" also contains some potassium.

"**How much should I put in my water?**" - well, water is safe to drink up to about 3000 mg/litre dissolved solids – that's 1/10 the salinity of sea water. However, the more salt in there, the more salty it will taste, and the more water you will need to drink. So I suggest that there is enough salt to give the water a faint mineral taste but not a salty taste. That means the dissolved solids will be below about 1000-1500 mg/litre. Or you can just put the salt in your food. Rehydration electrolytes can be happily boiled.

## The process of re-hydration

Re-hydrating is not straightforward. It's not like just wetting a sponge. If your body has had to adapt to a chronic shortage of water and/or electrolytes, then it will have to re-adapt back to a more normal (and healthier) physiological balance. First the more superficial parts hydrate, then the hydration affects deeper and deeper parts of the cellular structure. At some point your homeostatic balance has to find a new normal. Getting it to re-set to a more hydrated normal takes a while because if your body has adapted for thirst (as if you lived in a desert) it would not just recalibrate itself the first time you had a good drink.

So when the body first gets more water, it adapts pretty quickly – urine turning clear within a few days. However, if you continue to take in a bit more water than usual, you will find that this sometimes reverses – urine turns orange-yellow again for a while – or may go through various other colours, including shades of straw, blacky-yellow and bright yellow, along with needing to pee very frequently. What you are seeing is your body reversing the adaptations it made, and changing its balance. This might also precipitate short periods of exhaustion, and other symptoms.

I have also seen so many instances of people over-hydrating or otherwise not being in tune with their body that this written explanation is reaching its end. You should be in regular contact with someone who can check on quantities, symptoms/side effects, who can make sure you're not doing anything to excess. **Your body's homeostasis will sort itself out – that's its job – provided that you keep the rehydration as gentle, and as minimal as possible.**

**As a very general rule, RE-hydration means taking in about 1½ litres a day of water (i.e. not as tea or squash, etc). As room-temperature to warm water, not iced. That's about 2½ pints. Plus a little electrolyte (Sodium and Potassium), but not so much that the water tastes salty. Your health, lifestyle/exercise, climate, hydration history & diet *may* vary that figure, *usually* increasing it to some degree.**

**The required timeframe is about 1 or 2 months!!!**

## A few things that might help

### 1. Optional strategies to get more water in...

- Keep a glass full by the tap or where you work as a reminder. When it's empty, fill it again (this one's my favourite)
- When you have a drink of tea/coffee, also have a drink of water
- Fill bottles at the beginning of the day, so you know you have to empty them by the end of the day

### 2. What kind of water?

Plastic-bottled water contains microplastics, and so if I'm drinking bottled water I tend to go for glass-bottled (such as Harrogate Water) wherever possible.

Usually tap water is fine. Tap water in big cities (such as London) supply river water that's already been used by a few million other people - is not so good – because it contains pharmacological residues. In which case I prefer to find a bottled water.

Filtered water is also OK, but make sure that the filter is changed regularly. Old unmaintained filters just start to dump the rubbish back into the water that's passing through them.

Adding lemon juice will also help a detox process, but even this can be quite strong, and I would normally recommend you just use plain water(!)

### **3. Recovering a calibrated sense of thirst and salt-craving**

These ought to return once the rehydration process is complete.

However, they are also affected by blood sugar, so stress, caffeine, nicotine and various illnesses can change thirst/salt craving.

Use the new calibration to notice what kinds of foods make you thirsty. Ask whether this is because the food contains too much salt or sugar for your good health??

### **4. Food-water separation**

Another way that you can help your body to re-optimize its homeostasis is to reduce the adaptive load it has to endure each day. Drinking and eating at the same time puts a huge strain on the immune and digestive systems – so a simple way to increase your internal adaptive capacity is to separate fluids and solids. Drink no closer than ½ to 2 hours before a meal, and leave ½ to 2 hours after a meal before you drink substantial quantities. With no water, the stomach acids are undiluted, and will work far more efficiently. If you want to take probiotics or any herbs meant to reach the digestive tract (such as olive leaf extract powder) – then they are best taken with plenty of fluids. Obviously this food/water separation “rule” is not absolute, because soup is a meal!

Clearly, applying this rule means that you probably have to make quite large changes to how you structure your day. So, as with any dietary change, it's useful to ease your way in and apply some thought to how this is going to work. The greater the gap, the greater the effect, but the harder it is so manage hydration and life, so the full 2-hour separation is really for people who are incapacitated with an illness and have plenty of time through the day to think about these things. I find a ½-hour gap works well, and after a week or so, I started to find water with food quite unpleasant. This may be simple mental programming, of course. But I feel it is actually an increased awareness of how my stomach likes best to be treated.