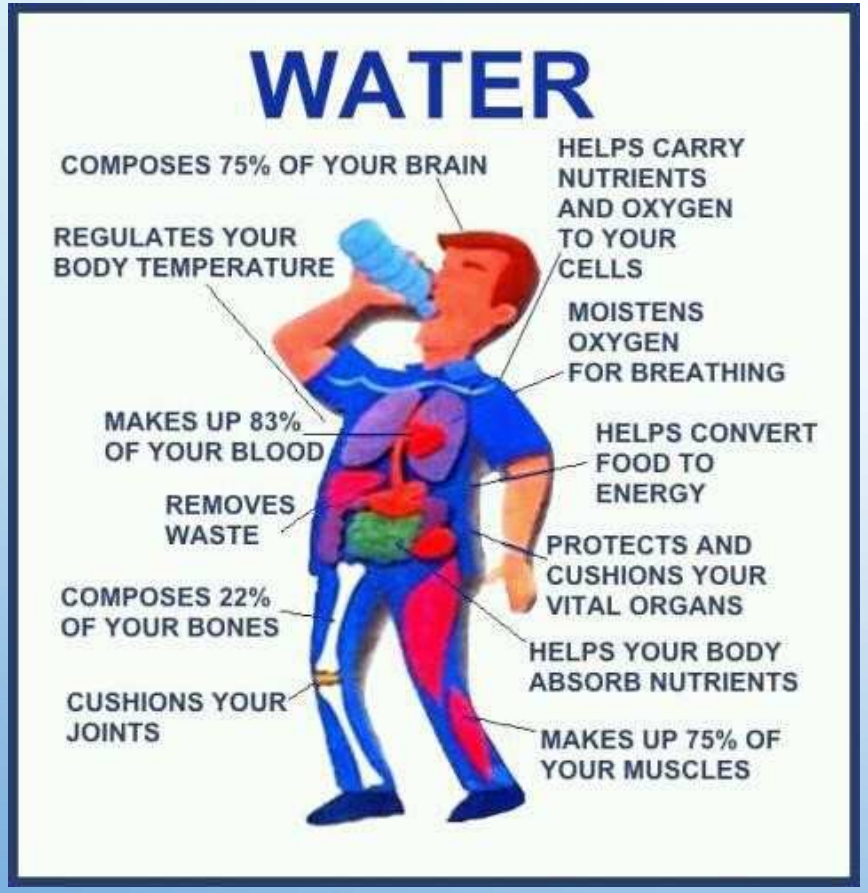
# Physiological Dehydration

## Causes, Effects and Prevention for Glider Pilots




All life requires water as the solvent or vehicle needed for physiologic processes to efficiently occur.

- A deficit in total organism water content results in disruption of metabolic/physiologic processes.
- This deficit occurs when total free water loss exceeds free water intake.
- This deficit is known as **dehydration**.
- In humans, **mild to severe dehydration** is noted as a range of conditions from **general discomfort to death**.
- To counter dehydration, free water intake, termed **hydration (often termed rehydration)**, must equal or exceed free water loss.

## How does a free water deficit occur?

In health water is lost by various means:

- Perspiration (evaporation of liquid water in and on skin);
- Breathing (loss of water vapour that's used to keep respiratory tract moist);
- Urination (loss of liquid water to eliminate wastes filtered from blood by kidneys);
- Defecation (loss liquid water needed to lubricate fecal movement);
- Evaporation of tears; and
- Evaporation of saliva.

# Loss of Electrolytes

- Whenever liquid water is lost, it carries with it certain electrically charged atoms that are **termed electrolytes**.

- Electrolytes are needed to facilitate nearly all physiologic functions by helping to create an optimal metabolic environment.

- The most common electrolytes are:

  sodium (Na+), potassium (K+), calcium (Ca+) and magnesium (Mg+)

- Thus, dehydration also results in the loss of essential electrolytes which further contributes to the symptoms of dehydration (e.g. salty perspiration, salt, sodium chloride crystals, on skin and clothing)

- Therefore, **hydration should also include replacement of lost electrolytes.**

# Symptoms of Dehydration

Some key symptoms that appear and become increasingly worse with increasing severity of dehydration:

- Headache and general discomfort
- Increased thirst
- Decreased urine volume output
- Darker urine colour
- Dry, “pinchable” skin (loosening wrist watch strap)
- Fatigue and listlessness
- Muscle cramps and joint pain
- Increased heart rate
- Impaired cognitive performance (after loss of only 1-2% of body water)
- Veritgo
- Confusion


- Over age 50 yrs, the thirst sensation diminishes and continues to decrease with age so thirst in older pilots is not a good indicator of dehydration.
- Decreased urine volume is not a good indicator of the degree of dehydration but colour can be helpful.

## Prevention of Dehydration in Glider Pilots

- Try to stay out of sunlight. Wear light coloured protective clothing. Stay under a shelter, use a broad brimmed hat or an umbrella. Keep as cool as possible!
- Cold water/ice cooled vests and neck surrounds are available (Google cooling vests for humans).
- While waiting in the cockpit, use a reflective canopy cover and/or a compact umbrella.
- Hydrate! The water used to hydrate should be supplemented with electrolytes. Pre-formulated electrolyte tablets and powders are available. Such supplemented water is absorbed quickly from the gastrointestinal tract.

- Prepared energy drinks (e.g. Gatorade) are not ideal for hydration as these are formulated for high performance physical activities (also contain a lot of sugar), not sedentary glider flying. But they do help!

- If you plan to use a prepared drink, make sure beforehand that your gastrointestinal tract will tolerate this. A large number of people, estimated to be 40% of the North American population, are not very tolerant of the sugar fructose use in such drinks.

- This condition is termed fructose intolerance and causes stomach discomfort/pain, gas and diarrhea.

- **Hydrate well before flying** by drinking small quantities of fluid repeatedly over at least an hour as this allows time for water and electrolytes to be absorbed from the gastrointestinal tract. Monitor using urine colour.

- Take a lot of fluid on the flight. Make sure your can reach it!

- During the flight, repeatedly sip fluid. Use a Camelpack type bag with the mouthpiece “velcroed” to the microphone boom. Time is required for the water and electrolytes to be absorbed.

- If you use a water bottle, there is a tendency to not drink enough and regularly.

- If using a condom catheter/urine collection bag, monitor urine colour in the bag as an indicator of hydration.

## Treatment of Dehydration

- First and foremost, if you are becoming dehydrated or already there, think carefully about landing out safely, especially if all of your water has been consumed.

- Remember, dehydration reduces cognition and judgement so landing out while you are “with the program” is a good decision.

- Even if you now begin to re-hydrate once you realize you’re dehydrated, this will take time to have an effect. You might not be able to do this before you’re no longer “with the program”.

- On the ground, move out of the sunlight. Keep drinking!

- Once you begin to re-hydrate or begin to consume fluid even if you don't think you are dehydrated, do this slowly, giving your body time to absorb the water and electrolytes. You'll need at least 45 minutes to rehydrate.

- Water without electrolytes is not ideal for re-hydration but it is better than nothing. The reason is that to absorb water alone from the gastrointestinal tract, your body will first pump some electrolytes into the gut, possibly contributing to the signs of dehydration.

- Then you will absorb the water…this takes time!

- You must consume the water slowly. If you do this too quickly, you'll have a huge inflow of water without enough electrolytes. This can be deleterious to organs as they become re-hydrated to quickly!

- Keep the fluid intake ongoing until you feel well and your urine output volume and colour return to normal.

- If you cannot recover by drinking, your degree of dehydration is likely severe! Go to a hospital where you can be re-hydrated safely.


When his sunglasses no longer had a place to rest, Chuck tried to remember what he had read about dehydration.

- You must figure out what works best for you!
- So you must experiment, mostly on the ground, the drinks that work best and that your gastrointestinal tract can tolerate.
- Lastly, if you are called out to pick up a pilot who has landed out, bring a cooler of cold drinks!