

Need a Drink?

The Dangers of Dehydration



“I was having difficulty doing anything beyond simply flying the aircraft. Over the next 10 minutes, the situation deteriorated. I didn’t realise it at first, but my peripheral vision was reducing quite quickly, almost as if two dark curtains were being drawn on each side of my head until I could only see straight ahead in a very limited arc”.

Has this ever happened to you? The pilot concerned was on a cross-country flight when he realised that he was very hot, and sweating profusely. He consumed a litre of water and began to feel better after about five minutes. His peripheral vision returned, as did logical thinking.

This pilot was suffering from dehydration. It is an extreme example but all pilots need to be aware that it is easy to become dehydrated while flying, and that dehydration will impair performance.

The Effects of Dehydration

The human body is made up of about 70 percent water. For example, a person weighing 77 kilograms (170 pounds) has more than 40 litres of water in and around the cells and in the bloodstream. This water is used for virtually every function the human body performs – regulating temperature, eliminating waste, digestion, transporting nutrients, and it also has a role in neurological and cognitive functions.

Water enters our body through our gut when we eat and drink. It exits our body through our skin and breathing, sweating, urination, and faecal loss. Normally, these processes will result in the body losing around 2 to 2.5 litres of water in a 24-hour

period, or about two to three percent of total body weight. Sweating can increase the amount of water lost from the body through evaporation on hot days, or after vigorous exercise, the loss can be substantial. If we are unwell, the loss of water from our bodies can be further increased through vomiting or diarrhoea.

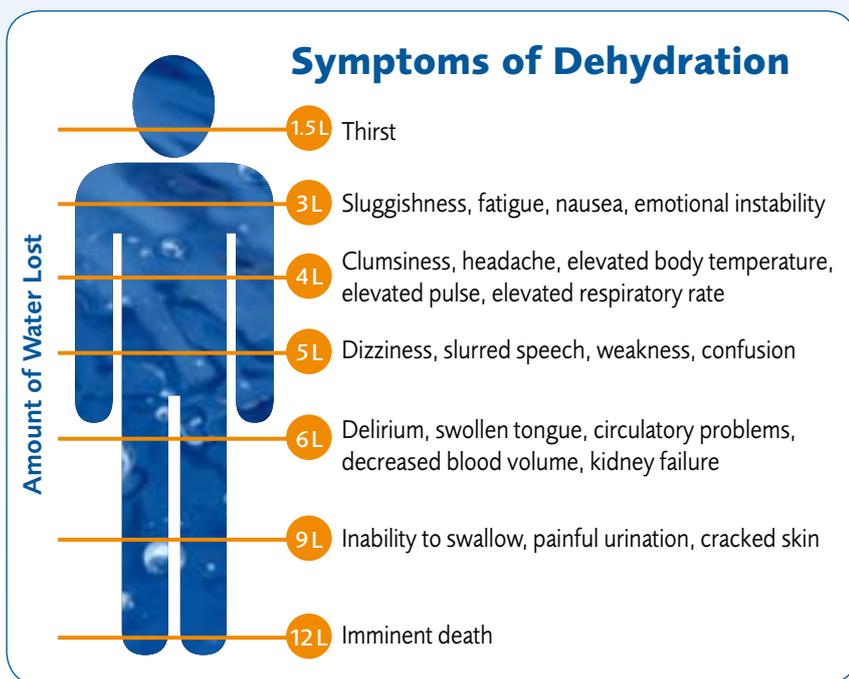
When we are dehydrated through not drinking enough, the concentration of salt in the blood usually rises. We become thirsty and drink. If water consumption is not sufficient to offset water loss, the kidneys excrete less urine, and perspiration decreases. This is the first stage of dehydration. For most people we become thirsty when we have lost 1.5 litres of water (around 2 percent of body weight). This level of dehydration triggers the ‘thirst mechanism’ and is a signal that we need to drink about 600 to

900 ml of water (depending on body size) straight away. The problem is that the thirst mechanism can be turned off too easily. A small amount of fluid in the mouth will turn this mechanism off and the replacement of needed body fluid is delayed.

After 3 litres of water lost, we start getting sluggish, tired, irritable, and maybe nauseated. This is a very dangerous level for pilots. It is where your faculties start to become affected, and you may not be aware of the deteriorated performance, such as impaired decision making and in-flight monitoring. As dehydration worsens, symptoms may include headache, dizziness, slurred speech, weakness, delirium, and kidney failure. If dehydration continues to around 12 litres of water, then we will most likely die.

Urine is a good indicator of our state of hydration. Normally, it should be clear with a yellowish tint. Darker yellow is a signal that you need more water.

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This is often the first sign of dehydration – even before you get thirsty. The exception is when you have taken more vitamins than your body can process straight away (such as a “multi-vitamin” tablet), and the excess vitamin stream often has a tendency to make your urine a bright yellow. Use of diuretic substances (those which increase the production and excretion of urine) such as alcohol, caffeine, and soft drinks that contain caffeine, will increase the risk of dehydration. In this situation the urine may not appear dark in colour, but fluid levels are being significantly depleted.

If you are not aware of the environmental conditions and your own personal physiological status (eg, if you are prone to sweating heavily), you can progress to heat exhaustion even if you are regularly drinking water. This typically occurs while working in hotter environments, where the external fluid intake cannot keep up with the loss of fluid by the body. In the milder form (heat stress) a person will experience a reduction in performance, coordination, decision-making ability, caution and caring. In the more extreme stages (heat stroke), symptoms include: cramping, fatigue, vomiting, rapid breathing, mental confusion, and loss of consciousness. It is important, therefore, to keep fluid levels up. In these environments, a person may require up to 8 litres of water per day.

Be aware that dehydration can also occur in colder weather. Cold dry air causes water loss from transpiration without us realising it. Additionally, cold weather can have a paradoxical effect, as the peripheral blood vessels contract to help conserve heat and direct fluid towards the kidneys and make the body think it has too much fluid.

Remember, the amount of water you need to drink will depend on work level, temperature, and individual physiology.



Ensure your water bottles are safely stowed so they don't fall onto the cockpit floor and possibly interfere with the rudder pedals.

One serious episode, or several repeated moderate episodes of dehydration can result in kidney stones for some people. These are stone-like masses of mineral salts which can cause intense, incapacitating pain while passing through the urinary tract. Other symptoms are fever, chills, blood in the urine, nausea, and vomiting. Diagnosis of a kidney stone may affect pilot licence privileges. For most people, however, the formation of kidney stones can generally be prevented by drinking adequate amounts of water.

Preventing Dehydration

In most instances, regularly drinking water will prevent mild dehydration. It is, however, important to replace sodium as you may get salt depleted. This can be achieved by eating regularly as food contains salt and water and it will help to prevent fluid loss. In more extreme conditions, a suitable rehydration fluid that contains the correct mixture of water, salt and sugar (the sugar is required to help the body absorb the salt) will be needed. Be wary of some 'sports drinks' as they are not ideal for rehydration and some contain caffeine. Cordial drinks are also not ideal as they contain a high level of sugar and little salt.

The following are recommendations for preventing dehydration and other heat-related problems:

- Drink about 1.6 to 2 litres of water every 24 hours for normal activities. Drink before you become thirsty, and drink from a container that allows you to measure your daily water consumption. In extreme climates, you may require up to 8 litres of a suitable rehydration fluid over a 24-hour period.
- Limit consumption of diuretics such as alcohol and caffeine.
- Recognise environments where the risk of dehydration is increased. For example, in hot weather dehydration is associated with heat exhaustion. In cold, dry weather we can lose a lot of water through breathing (transpiration). This is an insidious form of dehydration, as we don't usually feel thirsty when it's cold.
- Do not rely on thirst to be the signal that you need water. By that time, you are already on your way to dehydration. Also, drinking only a small amount of water, insufficient to rehydrate, may fool the thirst mechanism.
- The body absorbs water more effectively if it is consumed regularly, rather than drinking a large quantity of water quickly.
- Remember that your body's adjustment to a major change in weather, such as the onset of hot weather, can take one to two weeks.
- Dress appropriately. It is advisable to wear cotton or other materials that allow body heat to dissipate easily.

Dehydration and Flying

Preventing dehydration is simple – you have to keep your body fluids up. In aviation, this is not always easy. It is, however, important to be aware that dehydration can affect your flying performance and should be avoided. Avoid being dehydrated before commencing a flight. Start by limiting the amount of diuretics you have the night before. Ensure you have a good hydration level and a good sleep, so that you wake up with a good chance of maintaining a balance during the day. Ideally, drink a reasonable amount (1 or 2 glasses) well before departure. On warm or hot days, ensure that you are adequately hydrated before flight, as you may quickly become dehydrated in a hot cabin environment.

When flying, the practicality of remaining sufficiently hydrated can be a juggling act between consuming an appropriate amount of fluid and the need to use a toilet. It is a good idea to have a contingency plan, as a full bladder on a long flight can be very painful and distracting, making it difficult to make decisions.

For short flights (under one to two hours) water will most likely be sufficient for preventing dehydration. If you are doing regular short flights during the day, then it is also important to eat regularly, as food enhances fluid retention and absorption. **If you are flying for a longer duration, or in more extreme climates, a suitable rehydration fluid will be required.** As an example, a proven fluid that Dr Dave Baldwin (the 'flying doctor') uses and recommends is a mixture of one-third "Just Juice" and two-thirds water.

Remember that we should consume about two litres per day for normal activities (and greater amounts to cope with hot weather, high altitude, exercise, etc). If you are planning a long flight, work out how much fluid you need, and how you are going to store this. If you are flying in hot climates, then the amount of fluid required will be higher.

It can be difficult to carry water in aircraft with limited storage space. It may be possible to stow a water bladder with a straw, so that water can be consumed during flight. A water bladder commonly used by endurance athletes, obtainable from a sport shop may be suitable. Otherwise, carry a couple of bottles that allow you to monitor the amount of fluid you drink. Alternatively, consider planning your flight to incorporate stops where you can consume some fluid.



It is very important to carry sufficient rehydration fluid in the cockpit and to drink regularly.

To help prevent dehydration through sweating, keep the cabin well ventilated and dress appropriately for the cabin environment. Aircraft design will influence cabin temperature. In general, the cabin of a low-wing aircraft, especially one with a glass canopy, will be hotter than that of a high-wing aircraft. This problem can be compounded if the aircraft has poor ventilation. Be prepared to carry more water in low-wing aircraft, helicopters, or any aircraft with a large glass canopy, as the cockpit temperature may be 10 to 15 degrees higher than the outside air temperature (unless the aircraft has air-conditioning). The risk of dehydration will be increased, especially when flying on a hot day.

Dehydration can easily occur when flying long days on operations with little down time – on agricultural operations, for example.

At altitudes above 5000 feet amsl, the body experiences a higher loss of water through the surface area of the lungs than it does at sea level. This loss occurs because the percentage of water vapour in a given volume of air decreases with altitude. This water loss is not accompanied by a loss of salt (as occurs with sweating), so there is no accompanying sensation of thirst. For this reason, pilots who are making frequent flights above 5000 feet (such as parachute drop pilots, aerobatic pilots) should drink more water than their normal requirements, particularly during the summer.

If you are working night shifts, or on long-haul flights across different time zones, avoid using caffeinated drinks to keep you alert. These can make you dehydrated, and you will feel even more tired.

On long flights at higher altitudes, it is advisable to drink a suitable rehydration fluid every hour or so to replace the loss of body fluids. In a pressurised cockpit, the relative humidity of the atmosphere, which governs the available water vapour, can be as low as five percent. We 'operate' best in a relative humidity of 40 to 60 percent. In dry environments, we may not notice how much water we are losing from sweating, as it will very quickly evaporate from our skin. Be prepared to drink more than originally anticipated.

Remember, it can be easy to ignore the 'thirsty' signal, or to drink only a small amount of water that makes the thirst sensation go away.

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In some types of aircraft with limited storage space it may be difficult to stow water. It may be possible to use your flight bag.

If you have done this, and you start to feel fatigued or develop a headache, then seriously consider landing so you can have a break and consume some water.

Don't forget to drink water after flying to assist in recovering from possible dehydration, especially if you have been flying on a long sortie, on a hot day, and you have minimised your fluid intake to avoid using the toilet. It is very important to hydrate after your flight especially if you are flying the next day, to minimise your chances of becoming dehydrated the following day.

Summary

Dehydration can have serious effects on flight safety and in most situations is an easily avoided problem.

To avoid dehydration, ensure you are hydrated before flight.

Take the time to ensure you carry an appropriate amount of water or other suitable rehydration fluid for the conditions (eg, weather, type of aircraft) and the type of flight (eg, cross country, night operations). During flight consume your fluid (avoid using diuretics) at regular intervals, and eat regularly.

Don't forget to rehydrate after your flight. ■



New CAA Video

VFR in Controlled Airspace

This new production from Dove Video for the CAA aims to make pilots more comfortable with controlled airspace. While pilots taught at controlled aerodromes are probably very familiar with the airspace requirements, radio phraseology, and communicating with Air Traffic Controllers, many pilots taught at uncontrolled aerodromes fear dealing with Air Traffic Control (ATC).

This new video features two young pilots (played by Marion McCurdy and Cory Moir). One has more experience and is building flying hours toward her commercial licence, while the other has less experience and tends to avoid controlled airspace. The more-experienced pilot offers to take the other pilot along on a cross-country flight from Christchurch to Nelson so that the less-experienced pilot can become familiar with the requirements and radio calls.

They visit Airways' Christchurch Centre where an Air Traffic Controller (Clayton Lightfoot) discusses the flight plan and airspace en route. He then shows them a radar display and explains factors the controllers must take into account before giving a clearance.

After the flight, the less-experienced pilot feels much more confident with controlled airspace, saying, "I reckon it's worth a go".

Obtaining a CVFR clearance through controlled airspace has a number of advantages and can make your flight easier. ATC, as the service agency, are there to help and will do so whenever possible – and remember, it is not necessary to be on a flight plan in order to request CVFR.

The video includes some of our regular reminders:

- Take the weather into account when planning your flight, and no less so because it may be CVFR.
- Time spent studying the airspace en route before takeoff can make things much easier on the flight.

- As pilot-in-command, it is your responsibility to amend your SARTIME or terminate your flight plan.



VFR in Controlled Airspace is the first CAA video to be produced solely in DVD format, as will all future productions. With computers having DVD players in them, and DVD players available for very little cost, it is expected that this will be more convenient for everyone. This title can be purchased from Dove Video for \$18 (inc. GST) plus postage, or borrowed from the CAA (see information below).

The CAA has over 30 videos available for loan or purchase. See the complete list on the CAA web site, www.caa.govt.nz, under "Safety information – Videos". They can be borrowed by any CAA client within New Zealand. Just email info@caa.govt.nz with your name, client number, postal address, and the title of the video you would like to borrow. It is posted to you, and you are expected to return it within a week of receipt.



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