

Don't sweat and forget.

What you drink strongly affects how you fly, doctor and pilot, Ken Wishaw writes

For the majority of Australian pilots, be they commercial or recreational, a lot of time is spent in hot conditions. Dehydration is an often forgotten factor in flight safety and performance.

As a medical specialist, fluid physiology and management is a central part of my practice every day, and as a flying instructor I meet a lot of pilots who simply do not appreciate the hazards of dehydration, or how to assess and manage their fluids. Those I have taught about this matter say their performance is much better and their flying much more enjoyable.

In temperate conditions a person normally loses about 500 ml to one litre of fluid per day through sweating. In hot conditions, this can rise to as much as eight litres per day. Additionally we lose water at high altitude from breathing air with a low water content. Add to this the concentration required to fly aircraft and meet schedules, diverting our attention from thinking about thirst and hydration, and the scene is set for trouble.

A deficit of over one litre (or two per cent) due to failure to replace sweat losses can result in headaches, muscle cramps, dizziness and visual disturbances.

But hydration is more than just taking enough water. In fact just taking water may actually be harmful.

A few facts need to be understood as to why this is so.

Our blood and body fluids normally contain 135-150 millimoles (mmol) of sodium and 100 mmol of chloride per litre.

What we lose in sweat depends partly on our genetic makeup, but more importantly on whether we are acclimatised. The more acclimatised we are the less sodium and the more potassium we lose in our sweat.

Sodium losses for a person who is well acclimatised are of the order of 5-30 mmol per litre. For someone who is not acclimatised (say an office worker who flies one or two days a week) sodium losses in sweat may be 40-100 mmol/litre.

(As a crude way of appreciating of these figures, try tasting the following solution; one level teaspoon of table salt, which is sodium chloride, dissolved in a litre of water equals approximately 100 mmol/litre).

Our bodies possess a very sophisticated sodium control system. But it only works well if we are sufficiently hydrated to produce reasonable amounts of urine, and ingesting enough sodium and potassium which the kidneys can choose to retain or discard. Most of us readily excrete excess sodium and potassium in our urine. Conversely we also have a specific salt appetite. Pilots with low sodium levels often love salty foods at the end of the day!

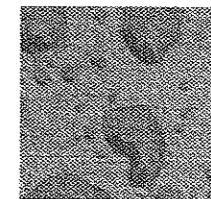
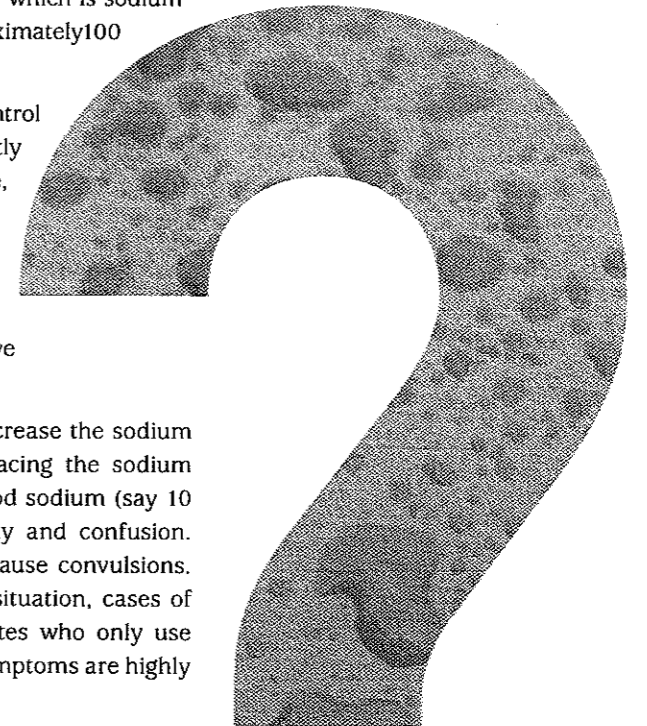
Ingestion of water to replace sweat losses will decrease the sodium concentration in our blood, as we are not replacing the sodium that we are losing. Severe acute decreases in blood sodium (say 10 per cent) may cause headaches, lethargy, apathy and confusion. Severe acute decreases (over 15 per cent) may cause convulsions. While this is extremely unlikely to occur in our situation, cases of convulsions have been documented in top athletes who only use water replacement. Suffice to say even the mild symptoms are highly undesirable for a pilot!

Potassium losses may cause low blood pressure and weakness.

Small amounts of sodium and potassium in rehydration fluids increase the rate at which the gut can absorb the fluid. Drinking only water, apart from leaving you still dehydrated (because you haven't absorbed the fluid) can make you feel bloated and nauseous.

Pure water ingestion tends to shut off the thirst reflex, even when we are dehydrated.

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Taste is a critical factor in whether athletes drink adequately during exercise. Some people love pure water, others loathe it.

High carbohydrate drinks such as energy drinks, fizzy drinks and fruit juice contain 10-30 per cent carbohydrate. Levels of carbohydrate over eight per cent inhibit intestinal absorption of the fluid. None of these are appropriate for rehydration during flight.

Athletic performance is severely degraded by dehydration, and a lot of research has been done into dehydration management. From this the sports drinks have evolved. They are not just commercial fads, but scientifically validated drinks that will optimise rehydration, and minimise electrolyte disturbance.

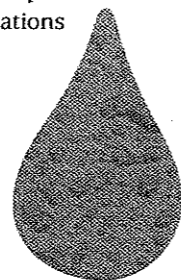
Sports drinks are not excessively high in sodium. At recommended strengths they contain 10-25 mmol/litre. They are also designed to replace potassium losses. They do contain carbohydrate, but this is of the order of six per cent which will not impede absorption or cause large fluctuations in blood sugar levels.

RECOMMENDATIONS

Guiding principles (on the basis that you are essentially fit and healthy) should therefore be

- ▶ Do not take off already dehydrated. Remember ground preparation is sweaty stuff.
- ▶ On short flights in temperate conditions whether we drink water or an electrolyte replacement is not critical.
- ▶ On longer flights (say over two hours) we should be aiming to replace what we are losing. Sports drinks are appropriate for this. The subtle differences between the brands and flavours are not as critical as what tastes good to you.
- ▶ The carbohydrate (sugar) content is not harmful. Carbohydrate ingestion could only lead to a problem if a large carbohydrate load is taken at widely separated intervals, with the risk of insulin over-secretion and low sugar levels occurring some hours later. Daily continuous sipping of sports drinks may theoretically lead to damage of tooth enamel. If you don't want so much glucose, then first mix the sports drink powder in a glass, then decant into your drink container. As electrolytes dissolve faster than sugar, this technique can leave most of the sugar behind.
- ▶ Do not dilute the sports drink from the recommended formula.
- ▶ Never take salt tablets, but if you have a desire for something salty, your body is telling you something and salty food may be just what you need.
- ▶ Food will help contribute to electrolyte intake.
- ▶ If you are on medication for high blood pressure you should discuss this with your doctor; however, you are unlikely to have problems provided that your electrolyte intake is not excessive.

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- ▶ Sports drink containers should be thoroughly cleaned every day.
- ▶ Heavy coffee and tea drinkers are prone to severe headaches on acute withdrawal. Recent studies have shown that caffeine is not deleterious to sport performance and a small amount on the long flying day before or after the flight is OK.
- ▶ For the technically minded, or if you are undertaking long flying you should meet these three criteria at the end of the flight.

1. Body weight loss should be less than two per cent.
2. Urine colour should be pale (drugs and B vitamins can alter this)
3. Urine volume should have exceeded 0.5 (ideally 1.0) ml per kilo per hour. If you fly a small aircraft, you must have a plan to handle the increased urine output. Deferring rehydration till after the flight is not an option!

By way of personal research I undertook two flights on successive days in a Super Dimona motor glider. Both days were very hot and dry, and the seven hour tasks were identical.

On the first day I stuck to a water regime. By the end of the day I was nauseous, bloated, had a severe headache and mild dizziness. I was so impaired that I opted to let the other pilot (and aircraft owner!) do the landing. My urine output was very poor, but I had gained weight during the flight, meaning a lot of water was just sitting in my gut.

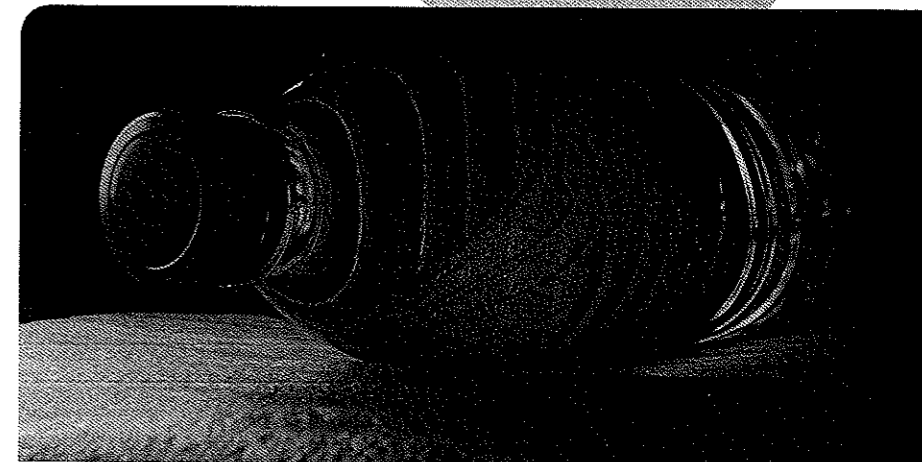
The following day was identical except that I used a sports drink. At the end of the day I had none of the effects of the previous day and a far healthier urine output. The flight was far more enjoyable (and we landed safely under my control).

Rehydration with the correct fluids will improve your flying performance, add to your enjoyment and make you a safer pilot.

For further reading on this subject there are excellent fact sheets at www.sportsdietitians.com.au

ABOUT THE AUTHOR

Ken Wishaw is an anaesthetist on the Sunshine Coast in Queensland. He was Australia's first full-time rescue helicopter doctor, and co-founder of the CareFlight Rescue Helicopter Service in Sydney. He has been a member of the RAAF medical reserve. He is an instructor at the Kingaroy gliding club and the Pacific Soaring motor-glider club at Caboolture. ☼



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