



## Dehydration, Both at Ground Level (GL) and When Flying (AGL)

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This is the summer season and heat levels vary across the country and around the world, leading to an increasing risk for dehydration. Dehydration is even a problem in the colder areas of the planet. The subject deserves to be reviewed regularly and frequently with our cadets and pilots to ensure the safety and well-being of everyone.

Dehydration is caused by a loss of fluid through perspiration, urination and **breathing**. While this can happen at any temperature, it is most prevalent at warmer temperatures, especially when exposed to sun and wind. Signs and symptoms may include thirst, darkening urine color, headache, dizziness, fatigue, and loss of concentration.

**There are three main classifications of heat-related illnesses caused by dehydration:**

**Heat cramps** – includes muscle cramping, significant thirst, and copious perspiration.

**Heat exhaustion** – is characterized by heavy perspiration, pale and clammy skin, fatigue, dizziness, fainting/loss of consciousness, and the development of confusion, poor decision making, and deteriorating performance.

**Heat stroke** – which includes worsening confusion, slurred speech, profuse sweating developing into hot and dry skin, loss of consciousness, and seizures. Heat stroke can be fatal as the body temperature rapidly increases. Emergency cooling (such as immersion in ice water) may be necessary to prevent loss of life.

The best way to cure dehydration is through the consumption of water, although coffee, tea, soft drinks, juices, soups, milk, and fruit are also helpful. While coffee, tea and soft drinks do provide some hydration, the amount of caffeine and sugar can increase urination, offsetting the hydrating effects and making them a less suitable choice. Sports drinks may provide some valuable electrolytes, but the amount of caffeine and sugar may limit their value. There is no role for salt tablets as that can lead to a hypernatremic state (too high a level of sodium in the blood), accompanied by heart irregularities.

### Ground Level Dehydration

Dehydration under most circumstances can be controlled by limiting outdoor exposure during the hotter times of the day, avoiding extreme heat, and consuming water regularly. Particular attention must be paid to Cadet Special Activities which could involve sustained exposure to elevated temperatures. Examples of such activities could include encampment, Hawk Mountain training, MOTS, PJOC, and any activities that potentially expose cadets to sustained exposure to elevated temperatures.

[Cadet Weather | Civil Air Patrol National Headquarters](#) provides additional guidance for when the temperatures are lower. Even at the weekly squadron meeting, GL hydration deserves attention.

Not having cadets stay outside, especially in the sun, is a good way to help prevent dehydration. Cadets should be instructed to hydrate well before arriving at the meeting or activity, in addition to the regular “hydrate, hydrate, hydrate” mantra from program officers. Obviously, re-hydration is much easier at ground level. Everyone, young or old, should be encouraged to hydrate regularly, drinking mostly water, and limiting sugar and caffeine-laden beverages and sports drinks.

## Above Ground Level Dehydration

Dehydration while flying can be even more complicated and serious than dehydration on the ground. The compromised pilot can cause disastrous results both in the air and on the ground. The FAA has even added dehydration to its list of flight hazards. Susceptibility to dehydration is compounded by a hot apron and ramp, long hold-shorts on the taxi way, being confined in a hot cockpit, often with little cooling ventilation, and bright sunlight at altitude when flying above the clouds. These factors may cause a dramatic increase in fluid loss by the pilots and aircrew.

[Effects of Hydration on Cognitive Function of Pilots | Military Medicine | Oxford Academic](#), 40 randomly selected pilots, screened for inclusion, were analyzed, and scored for performance, spatial cognition, and memory both when properly hydrated and when experiencing dehydration. The results revealed that dehydration had a significant negative effect at altitude.

Fluid loss resulting from dehydration can cause a condition known as hypovolemic shock. Hypovolemic shock occurs when the blood volume is reduced due to fluid loss, leading to a drop in blood pressure. Since the blood circulates oxygen throughout the body, reduced blood volume and blood pressure, and a subsequent drop in blood flow decreases the amount of oxygen available to the effected individual. Flying dehydrated at altitude compounds this by further reducing the amount of oxygen available to the pilot and aircrew. Below shows the effective oxygen available to the hydrated pilot.

- Effective oxygen at sea level = 20.9%
- Effective oxygen at 1000' MSL = 20.1%
- Effective oxygen at 3000' MSL = 19.4%
- Effective oxygen at 6000' MSL = 16.6%
- Effective oxygen at 8000' MSL = 15.4%
- Effective oxygen at 10,000 MSL = 14.3%

In these conditions, oxygen level is decreased and the pilot and aircrew flying at these altitudes can be seriously compromised in terms of cognition, memory, and performance, all of which will be worsened by dehydration.

### Many recommendations abound for controlling dehydration in the cockpit.

These include such things as:

- Drinking a minimum of 40 ounces of cool water before ever setting foot in the aircraft.
- Bringing along a small cooler to hold cool water.
- Drinking smaller amounts of water more frequently is effective.
- Limit sodium-laden snacks and carry fruit or granola type bars.

Recommended consumption of fluids per day:

- Males is 14-15 cups of water.
- Females is 11-15 cups of water.

Be mindful of the appropriate calorie intake for males, females, and age groups. This varies widely based on activities, temperature, etc.

Dehydration can also effect females on their menstrual cycle. Fluid retention/loss can be an issue, especially with irregular or heavy flow and in those menstruating for the first time. This can be significantly important to know particularly at events such encampments or other events.

In conclusion, all CAP members should be reminded periodically of the causes of dehydration, the dangers of dehydration, the three main conditions caused by dehydration, the effect of dehydration in the cockpit and lastly how to make good decisions about rehydration choices.

**Sources:**

<https://www.mayoclinic.org/healthy-lifestyle/nutrition-and-healthy-eating/in-depth/water/art>

<https://www.planeandpilotmag.com/articly/flying-high-and-dry>