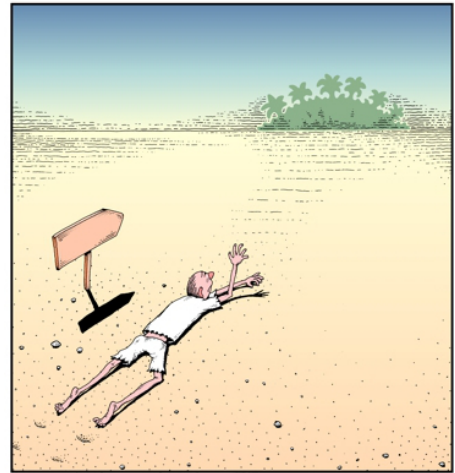


# Hydration

By Tamara Mitchell



Whether you play an active sport, work hard in the garden on a warm day, or simply sit at your computer, your body loses moisture throughout the day through perspiration, respiration, and going to the bathroom. If it's a hot day and you do something active, you will need to replenish more body fluids than if you're sitting in the air conditioning working at your desk, but just as your body burns calories through simply existing, it also loses moisture.

Water is used by your body for all kinds of functions:<sup>1</sup>

- temperature control
- joint lubrication
- nerve and muscle functioning
- removing waste products
- maintaining heart rate and blood pressure
- maintaining a healthy metabolism

It's important to take in fluids to keep the body functioning well and to keep our body's electrolytes in balance.<sup>1</sup> The body begins to shut down when it begins to become too dehydrated.<sup>1</sup> But, there is a huge number of myths about hydration that need to be examined and much of the research on the subject is fairly surprising.

## Is water best?

In terms of cost-effectiveness and often the healthfulness of ingredients, you can't beat pure water. The Beverage Guidance Panel was assembled to provide guidance on the health and nutritional benefits and risks of various beverage categories.<sup>2</sup> Consumption of artificially sweetened soft drinks and fruit drinks has increased dramatically since the mid-1970's. Caloric intake from mostly calorically sweetened beverages for Americans over 2 years of age now makes up about 21% of total energy intake.<sup>2</sup> Research has shown that fluids don't make a person feel very satiated, so people still tend to eat their usual portions of solid or semi-solid food, but they take in a lot more additional calories when they drink soft drinks or sweetened fruit-flavored beverages when a non-caloric beverage would suffice.<sup>2</sup>

Some people don't really care for plain water. Does that cup of joe in the morning or the glass of ice tea count for or against your fluid consumption? And what about drinking sodas, colas, fruit juices, or sports drinks?

*Water is derived from every source.*

We've been told so many times that drinking pure water is the only thing that counts toward hydration, but it turns out that is not true, with some caveats. The recent research clearly shows that it really doesn't matter what you drink if you are strictly looking at hydration.<sup>1,3,4,5</sup> Reference 5 was funded by the Coca-Cola Company, so their research draws some skepticism, but the results have been repeated by other researchers with independent funding sources. The body really does extract water from many different beverage sources. Although caffeine is a diuretic, research shows that it makes no difference in hydration or in fluid-electrolyte balance, though the amount of caffeine studied was equivalent to 1-2 cups of coffee per day.<sup>6</sup> Larger amounts of caffeine may well have a detrimental effect on hydration and certainly has an effect on health in other ways including headaches, restlessness, and anxiety.<sup>7</sup> Black tea has been found to have many health benefits and may reduce cancer risk, increase immunity, increase bone density, reduce tooth decay, reduce kidney stones, and reduce the risk for cardiovascular disease.<sup>2</sup> Coffee has been found to potentially reduce the risk of type 2 diabetes, reduce the risk of Parkinson's disease in men (but not in women), though it appears to increase some of the risk factors for cardiovascular disease when large quantities are ingested.<sup>2</sup>

In fact, there are lots and lots of foods that contain water and they count in body hydration, too! Soup, yogurt, fruits, and veggies all contain large amounts of water that gets absorbed by your body as this food is digested.<sup>1</sup>

*What about sports drinks, energy drinks, and coconut water?*

Many people, including children, don't really understand the difference between an energy drink and a sports drink.<sup>8</sup> If the goal is to rehydrate, energy drinks are not the way to go. Children and adolescents should definitely not be drinking these beverages because they contain a lot of caffeine and other stimulants such as guarana and taurine which have been linked to harmful effects on developing neurological and cardiovascular systems.<sup>8</sup>

Sports drinks contain a lot of sugar usually in the form of high-fructose corn syrup which can lead to obesity and tooth decay.<sup>8</sup> They also contain artificial color and artificial flavorings and they are stored in plastic bottles which can leach into the water.<sup>9,10</sup> That is counterproductive to fitness and exercise!

Coconut water has been marketed as an alternative to unhealthy sports drinks, but it has actually been consumed since ancient times.<sup>11</sup> Natural coconut water is the liquid derived directly from the center of the coconut fruit. Coconut water naturally contains sugars, minerals, especially potassium, amino acids, and aromatic compounds.<sup>11</sup> It is low in acidity and with its well-balanced profile of natural sugars and minerals, it can be of value in rehydration and as a sports drink, though the composition of coconut water varies greatly depending on the variety of coconut and the maturity of the fruit.<sup>11</sup> One study found no difference between coconut water, coconut water from concentrate, plain water, and sports drinks in the ability to rehydrate the body, though subjects experienced more feelings of bloat and stomach upset with both the

coconut water and the coconut water from concentrate.<sup>12</sup> It should be noted that coconut palms are often heavily sprayed with pesticides and research has shown that industrialized coconut water had higher levels of pesticides than natural coconut water.<sup>13</sup>

It's so easy to make your own sports drink and flavored beverages, there is really no reason to spend money on alternative beverages or worry about the healthfulness of ingredients. You can concoct an excellent, organic sports beverage very inexpensively and easily.

**Sports drink recipes:** <http://empoweredsustenance.com/adaptogenic-sports-drink/>

*What about beer, wine, and alcohol?*

The body does extract fluid from alcoholic beverages. On a scale of nutritive and health benefits, beer and wine have more nutrients than soft drinks and fruit-flavored beverages. They are heavy on the calories, however, so moderation is important.<sup>2</sup> Light to moderate consumption of alcohol can reduce cardiovascular problems and strokes.<sup>2</sup> However, even at moderate rates, alcohol is linked to an increased risk of birth defects and breast cancer.<sup>2</sup> At greater than moderate consumption levels, alcohol is associated with cirrhosis of the liver, hypertension, stroke, cardiovascular failures, and dementia.<sup>2</sup>

### **Healthy Hydration.**

Your body can and does extract the water it needs to survive from many sources. Before everyone rejoices and grabs a beer, it's important to take into account the processing your body needs to do to obtain the water it needs and how the various beverage alternatives stack up in terms of overall healthfulness. Obviously, some food sources are digested anyway, but guzzling a lot of caffeinated, sugary, artificially colored/flavored, or alcoholic beverages requires your body to filter out everything it doesn't really need in order to obtain the water and all those artificial additives tend to have cumulative negative effects on health. It's important, just as with everything else in your diet, to look at the overall healthfulness of the beverage. Sweetened still and fizzy beverages, including sports drinks, are at the absolute bottom of the heap in terms of healthy hydration.<sup>2</sup>

The more pure your water is, the better it is for your body and the easier it is to simply replenish what you've lost during the day or during an exercise session. At least 80% of the daily fluid intake is recommended to be water, unsweetened tea or coffee (without cream or other additives).<sup>2</sup> The remaining 20% can be low or nonfat milk, juice, alcohol, or sweetened beverages.<sup>2</sup> If you're bored with plain water, try making some naturally flavored water to keep on hand.

**Flavored water recipes:** <http://greatist.com/health/flavored-water-healthy-recipe>

*How safe is tap water?*

Depending on where you live, there are different concentrations of various contaminants in your tap water. If your water source is from ground water or a water treatment plant, you are likely exposing yourself to some fairly dangerous toxins. Despite reassurances by water treatment facilities, the fact remains that there is a wide range of compounds in tap water that have a potential to be harmful if consumed, or even breathed or absorbed through the skin when showering or bathing over a lifetime.<sup>14</sup> The EPA requires utilities to provide a consumer confidence report (CCR) to customers once a year.<sup>15</sup> There are very few utilities who have not

violated federal water-quality standards on some contaminants, there is no assurance that contaminants in the test samples are the same as what comes out of your tap, and there are often spikes in contaminant levels that far exceed federal standards and that go undetected.<sup>15</sup> If you live where there is well water, you can call EPA's Safe Drinking Water Hotline (800-426-4791) for local state-certified testing labs or for information on your local health authority.<sup>15</sup>

Be aware that there are many, many chemicals that are neither tested nor treated in tap water.<sup>14,16</sup> For example, tap water may contain carcinogenic musk compounds from perfumes, chlorine used to disinfect drinking water, chemicals used in dishwashing detergents, arsenic, pesticides, and chemicals used in petroleum extraction. Other chemicals with unknown but potential toxicity and/or hormone disruption are neither detected nor filtered from tap water such as pharmaceutical drugs, siloxanes used in non-stick cookware, stain resistant carpeting, lotions or hair-care products, and fat-free foods, perchlorates used as a propellant in everything from missiles and fireworks, to exhaust from vehicles.<sup>14,17</sup> In areas where the local tap water is treated with fluoride or where fluoride naturally occurs due to dissolving local mineral deposits, research has shown that concentrations over 2 mg/L can cause damage to the liver and kidneys in children, especially those who also are treated with dental fluorosis.<sup>18</sup> A Canadian study found that women are flushing enough birth control hormones down the toilet in the form of human waste that *male* fish downstream were producing eggs!<sup>19</sup>

#### *How safe is bottled water?*

The FDA standards for the purity of bottled water are similar to tap water supplies (which are regulated by the EPA, not the FDA), though in instances where the FDA feels that the type of contamination is due to the nature of tap water, the standards are lower for bottled water than for tap water.<sup>20</sup> For instance, the levels of lead allowed in bottled water is higher than for tap water because it is felt that lead may leach into tap water from lead pipes that carry water, whereas this is not a problem for bottled water.<sup>20</sup> This seems somewhat counterintuitive because what is a safe level of lead should actually be exactly the same in the end product regardless of the likelihood of risk. The hurdle should not be lowered because FDA expects it to be cleared.

The best way to ensure a pure source of water is to drink water that has been subjected to one or more purification methods. Once you know what contaminants are in your water, you can make a choice about whether you need a water filter or what type will work best for you. No single purification method will eliminate 100% of every single potential contaminant in water. The National Sanitation Foundation has an excellent checklist that you can use to determine a certified water filter that will purify the contaminants in your particular water source: <http://info.nsf.org/Certified/DWTU/>.<sup>15</sup> There is a comparison table on the Reverse Osmosis Water Filter Buyers Guide website that compares some common contaminants, though it is not an exhaustive list and doesn't include endocrine disrupting hormones, one of the hardest pollutants to eliminate: <http://www.reverse-osmosis-water-filter-guide.com/compare-filtrations-methods.html>. Organisms in the water require a different filter than cyanide or bisphenol A, and just because the water tastes better does not mean it is pure and free from harmful contaminants, though certainly pure water does taste good! Determining the best filter for your needs requires significant research on your part. Consumer Reports does not test for most contaminants in determining their ratings. The information about contaminants on water filter sales websites is

often quite good, but they are often noncommittal about exactly what their particular filter eliminates.

There are many types of water filters on the market including water pitchers, countertop and under-sink filters that filter tap water at one particular faucet, and whole-house filtration systems that will deliver pure water to every water fixture in your house. Whole house filtration ensures that water used for brushing your teeth and absorbed through the skin or inhaled during bathing is also pure.<sup>21</sup> Whatever system you use, make sure that you follow the manufacturer's instructions, change filters, and perform back-flushing on a recommended schedule. Using exhausted filters is ineffective at best and can actually harbor bacteria and put toxins back into the water. Once your water is filtered, you can carry it in a metal or glass container that will not leach chemicals back into the water. After the initial cost of the filter, you will have a source of pure water for many years.



Photo courtesy Aquasana.com

Reverse osmosis has proven to be one of the best method for eliminating endocrine disrupting hormones, followed by nano-membranes, then ultra-membranes, and least successful is micro-membranes.<sup>22</sup> They also filter out beneficial trace minerals which, in the marketing materials is regarded as insignificant in comparison to dietary sources of minerals.<sup>10,23</sup> In one major study in Norway, however, lower trace minerals in local water supplies was associated with significantly more hip fractures.<sup>24</sup> Membranes filter out microbes, viruses, pesticides, pharmaceuticals, and personal care compounds.<sup>22</sup> Removal of endocrine-disrupting compounds however, depends to a great extent on the type of membrane.<sup>22</sup>

Activated charcoal filters are also one of the best ways to eliminate pharmaceuticals, endocrine disrupting hormones, and cyanobacterial toxins. The type of filter and it's age result in widely varying effectiveness, but if you purchase a reputable brand like the Berkey or AquaRain and replace the filters every year or so, you will be assured of high quality water.<sup>22,25</sup>



Photo courtesy of AquaRain.com

Wastewater treatment plants may or may not employ one of several methods to remove endocrine disrupting hormones including activated sludge processing, chemical precipitation, aerating volatilization, sludge absorption, and biodegradation.<sup>22</sup> Results of these methods vary widely.<sup>22</sup> Removal of all types of endocrine disruptors appears very complete with a combination of UV and hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) treatments, and this combination is effective in eliminating natural organic matter, pesticides, micro-pollutants that affect taste and odor, as well as disinfection.<sup>22,26</sup>

Home UV purification systems are common in some parts of the world where general contamination is a problem and this may be an option for some people, but if you are on a municipal water system, further disinfection of your water is not needed. They are expensive,

but they should include pre-filtration with a charcoal and ceramic filter element before the water is flowed very close to a UV lamp.<sup>27</sup>

### *Weight loss aid?*

There is some evidence that drinking water with a meal will make you feel more satiated, but details are lacking regarding the amount of water that is ideal, what effect it really has on reducing food intake, or how long satiety lasts.<sup>28</sup> What does appear to be effective in curtailing the appetite is to consume water incorporated into food, such as soup, prior to eating a meal.<sup>28</sup> Preloading with soup was much more effective in reducing appetite than preloading with water.<sup>28</sup> It appears that this may be a good way to reduce overall calorie consumption as long as the preloading soup or other watery food is not a fattening recipe. Stick with broth-type soups for the best benefit.

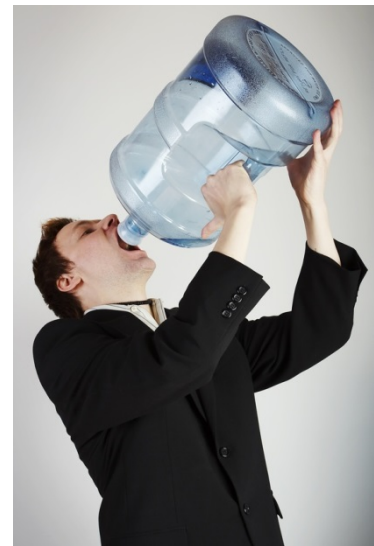
### *Is ice water good or bad?*

There is a persistent urban legend regarding the consumption of ice water, specifically that it can cause cancer. It was rumored that ice water ingested with a meal solidifies fats you have just consumed, slows down digestion resulting in a sludge that causes cancer.<sup>29,30</sup> We did our own search of scientific studies and found no research at all to support these rumors. Both Reference 29 and Reference 30 are in agreement. The body very quickly warms up any cold beverage that is ingested and pulverizes any food that is eaten. Everything that enters the intestines will resemble a smoothie at 98.6°. There is no sludge and drinking ice water does not cause cancer.<sup>29,30</sup>

There is also disagreement about whether drinking ice water or tepid water is better for you during and after exercising.<sup>30</sup> Some claim that ice water helps cool the body temperature down when overheated from exercising, others claim that tepid water is better because the need to heat cold water requires energy and some fluid loss.<sup>30</sup> Whatever the effect of chilled water, it is probably minimal. Drinking cold water does cause people to drink more because it tastes better, so if you are trying to hydrate after a heavy workout, cold water might be a better choice.<sup>30</sup>

### **How much is the right amount?**

Like so many questions in life, the answer is, “It depends”! We’ve all heard that we must drink 8, 8 oz. glasses of water a day, and many of us have felt guilty on days when we have forgotten to chug down that much. In reality, there is no hard and fast rule because what your body requires is a function of how active you are, how much you sweat, how hot and dry the weather is, and, as discussed above, whether you have consumed a lot of other water in the form of other foods and beverages.<sup>1</sup> Actually, most people probably consume enough water to stay hydrated. The 8 x 8 rule appears to be completely unsubstantiated by any scientific research and it is likely excessive for the average reasonably healthy person in a temperate climate and leading a relatively sedentary lifestyle with some mild exercise, like walking.<sup>1,28</sup> A couple of ways to tell is, if you urinate every 2-3 hours and the urine is a pale straw color.<sup>1</sup>



There is evidence that for people who have certain health issues, drinking more water can help. Research is inconclusive, but there may be possible benefits in the prevention of bladder cancer, colorectal cancer and precancerous polyps, fatal coronary heart disease, renal failure, and high blood pressure.<sup>28</sup> Since some of these conditions tend to develop as many people age and are often undetected, it may be beneficial to increase water intake as a preventive measure.

Small fluctuations in hydration can actually be detrimental. As little as a 2% decrease in body water can result in decreased athletic performance.<sup>1</sup> At 3-4%, other more serious symptoms can result.<sup>1,2</sup>

- Increased heart rate/rapid pulse
- Increased body temperature
- Severe anxiety
- Confusion and reduced cognition
- Moodiness
- Inability to stay awake
- Faintness that is not relieved by lying down
- Inability to stand or walk
- Rapid breathing
- Loss of consciousness

Also, dehydration can be the cause of headaches and cramping, so if you experience these symptoms you should try increasing your water intake.<sup>1</sup>

### **What does it mean when I feel thirsty?**

It is rumored and even stated in some scientific journals that by the time you feel thirsty, you are already somewhat dehydrated.<sup>28</sup> Actually, this is rarely true. A change in the electrolyte balance of just 2% can result in the sensation of thirst, however a level of 3% is considered the beginning of dehydration.<sup>28</sup> The body's reaction to changes in osmosis is extremely quick and accurate, so it is generally unlikely that people do not feel thirst in time to regulate their hydration level since the kidneys immediately start conserving water by concentrating the urine.<sup>28</sup>

There are a few cases where otherwise healthy people may not feel thirsty and result in dehydration.

- When you are exercising very hard or it's very hot, you may get dehydrated before you actually feel thirsty. It can actually take hours before you realize that you are dehydrated, often with a headache or muscle cramps. If you know you're going to be outside, participating in an activity that will cause you to sweat, or if it's going to be a hot day, it's a good idea to get a head start on hydrating your body. Drink some water as soon as you get up, before you drink or eat anything else. Prevent dehydration if your fluid loss is going to be rapid and extreme during the day rather than trying to play catch-up later.<sup>1</sup>
- In the elderly, there is an increased risk of dehydration and over-hydration because the thirst mechanism becomes impaired and the ability of the body to respond to electrolyte and sodium imbalances is decreased.<sup>31</sup> Kidney functioning is often diminished, so there is also a

decrease in the ability to concentrate urine.<sup>31</sup> By the age of 75-80 total body water content, especially in women, is decreased by 5-10%.<sup>31</sup>

### **Too much of a good thing?**

There are physiological mechanisms that make you feel thirsty when you need to hydrate, but there is no mechanism to tell you when you've had enough. Most people don't super-hydrate on a regular basis, so it's not something that we generally have to worry about. The technical term is hyponatremia and it's dangerous from the standpoint that it dilutes the body's sodium levels.<sup>1</sup> It rarely occurs because the kidneys are very efficient at producing large volumes of urine quickly to regulate the body's water balance.<sup>2</sup> Hyponatremia is most common among athletes who participate in activities for long durations such as triathlons and they consume large amounts of fluids for hours and hours.<sup>1</sup> As a rule, you should replace the fluids you lose during exercise. So endurance athletes should weigh themselves before exercising, then again after exercising. A weight gain would indicate that too much fluid has been consumed and a weight loss would indicate that not enough fluid has been consumed.<sup>1</sup>

### **Enhancing water**

Many of us have heard about adding electrolytes to drinks to replenish the supply lost in activities where we perspire, but research is now pointing toward the benefits of enhancing drinking water with hydrogen molecules or drinking alkaline water with a higher pH than normal tap or bottled waters (pH 6.7 to 7.4). Here's the scoop.

#### *Electrolytes in water*

Sweat contains electrolytes, primarily sodium chloride, but also some potassium, calcium, and magnesium.<sup>32</sup> Sweat glands in the skin have the ability to reabsorb electrolytes and this ability is increased as the body adapts by increasing the sodium absorbed.<sup>32</sup> Most people consume far too much sodium in their normal diet as a ratio to potassium, so addition of sodium to beverages for hydration is not necessary unless there is excessive sweating over a prolonged period of time.<sup>32,33</sup>

#### *Hydrogen-rich water*

There are a lot of fairly expensive devices that claim to infuse water with hydrogen molecules. It pays to be skeptical of any product that proposes somewhat wild health claims and curative effects. In reality, though, the health benefits of hydrogen has been scientifically studied for about 40 years.<sup>34</sup> Enhancing water with molecular hydrogen (H<sub>2</sub>) creates a powerful antioxidant as the hydrogen quickly neutralizes free radicals (usually oxygen radicals) and it has been found to be a safe alkalizing agent.<sup>35</sup> Very little hydrogen produces a big result, but so far research has not been able to pin down an effective dosage.<sup>36</sup> This is of particular interest to athletes who develop plasma acidity, but hydrogen-rich water has been found to be beneficial to health in many other ways. Benefits in human and animal studies have been wide-ranging including:<sup>36,37,38,39,40,41,42</sup>

Relief and possible protection of the stomach lining from aspirin

- Reduction in kidney failure during chemotherapy
- Prevention and treatment of type 2 diabetes and insulin resistance
- Acute pancreatitis
- Liver tumors and chronic liver disease
- Atherosclerosis and arteriosclerosis.



We aren't going to review the products available that can charge water with hydrogen molecules, but bubbling hydrogen gas into water will not work especially well, since it will dissipate almost immediately. Although probably the most inexpensive method, the use of magnesium metal in a bottle of water causes a chemical reaction that supersaturates the water with hydrogen.<sup>43</sup> If this is done inside a sealed bottle in water that is acidic, the resulting water will likely have the best retention of hydrogen molecules, which you can then ingest.<sup>43</sup> Dosage is not known, but there is virtually no potential for toxicity. Reviews of a fairly inexpensive stick that can be soaked in a sealed water bottle are purely subjective, but many have found it helpful.<sup>44</sup> One cannot actually feel the effects of antioxidants in the body, so we will have to wait for more research to determine the effectiveness and dosage of such devices.



### *Alkaline water*

People who suffer from acid reflux can benefit from drinking alkaline water (pH 8.8) as it instantly and irreversibly inactivates human pepsin.<sup>45</sup> Alkaline bicarbonate-rich waters with high concentrations of calcium, but low concentrations of sulfate have been shown to reduce mineral loss in postmenopausal women.<sup>46</sup> This effect exceeded mineral waters that were simply calcium-rich, or were calcium-rich and acidic.<sup>46</sup> Studies used either 1 liters/day or 2 liters/day consumption of various brands of alkaline bicarbonate-rich water. Low sulfate concentration is desired because it can inhibit the absorption of calcium. Two brands of water studied showed the best profile for alkaline bicarbonate-rich water and low sulfate concentration: French Quezac and Polish Kryniczanka.<sup>46</sup>

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This article and all of our articles are intended for your information and education. We are not experts in the diagnosis and treatment of specific medical or mental problems. When dealing with a severe problem, please consult your healthcare or mental health professional and research the alternatives available for your particular diagnosis prior to embarking on a treatment plan. You are ultimately responsible for your health and treatment!

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