

Nutrition and Health Info Sheet

Water

For Health Professionals

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What are the functions of water in the body?

Water is a simple molecule composed of two hydrogen atoms attached to one oxygen atom. It accounts for 55% - 65% of the human body.¹ Water is most often thought of in its roles in bodily fluids, such as blood and saliva, but the majority of water in the human body is actually located within cells. Approximately two-thirds of total body water resides as intracellular fluid, compared to the one-third in the extracellular fluid.² Within all cells, water serves vital functions involved in transport, waste management, and energy metabolism.³

Many biological processes require water. It is critical for maintaining body temperature and is used in waste disposal to dilute harmful compounds such as urea.³

What are the recommendations for water intake?

Water intake is extremely variable from day to day, and from person to person.^{4,5} While a Recommended Dietary Allowance (RDA) is not currently established for water, Adequate Intake (AI) levels have been set as 2.7-3.7 liters per day for healthy adults.^{6,7} It is important to note that water from other foods and beverages also counts toward this total. Moisture in fruits, vegetables, and other foods account for approximately 20% of daily intake.⁷



Daily water consumption varies significantly between individuals, and differences can be based on many factors.⁵ Those who partake in vigorous exercise may have greater water needs, due to increased losses from sweating. Elderly individuals may also have higher water needs, as advanced age has been associated with greater risk of dehydration due to lower body fluid volume. Parents and caregivers of young children should also be mindful of a child's water needs, especially during play and warm weather.^{8,9}

What is dehydration and how is it prevented?

Dehydration can occur when fluid losses exceed fluid intake. Although marketing efforts from beverage companies often cite dehydration as a major concern, dehydration in healthy individuals is easily avoidable.¹⁰

Fluid balance is tightly regulated, both in terms of consumption cues (thirst) and water losses. When the body loses fluids, fluid volume in the body decreases, signaling a hormonal response that reduces fluid losses by concentrating urine and increasing fluid intake through increased thirst.¹¹ By decreasing fluid excretion and increasing fluid consumption, the resulting increase in extracellular fluid volume signals an end to these responses, and water balance is restored.²

In the event that measures to restore fluid balance fail, dehydration can occur. Symptoms can range from moderate to severe, as described in Table 1.

What is water toxicity?

There is no recorded Toxic Upper Limit (UL) for water, although there have been cases where injury or death has occurred after drinking excessive amounts of water. Normally functioning kidneys are able to handle and excrete enough water to maintain fluid balance. High levels of water intake result in increased frequency of urination, resulting in urine with a very light-yellow color, or perceived as clear.

Acute water toxicity and even death have been reported in rare cases wherein individuals consumed large quantities of water, which diluted solutes in the body, most notably sodium.¹³ Reports of hyponatremia (low blood sodium levels) have occurred when endurance athletes replenish water during events like marathons, with little replenishment of sodium. This Exercise-associated hyponatremia (EAH) features symptoms of nausea, vomiting, fatigue, and impaired performance. If left untreated, a continued reduction in serum sodium levels may result in hyponatremic encephalopathy (EAHE), which is characterized by headache, convulsions/seizures, and/or coma.^{14,15} The American College of Sports Medicine recommend that fluids used to replace those lost during endurance events contain carbohydrates and electrolytes.¹⁶

Prevention of EAH and EAHE¹⁴

1. Teach athletes to drink according to the dictates of thirst before, during, and after exercise.
2. Physicians treating collapsed athletes with an altered level of consciousness should not infuse any fluids intravenously until a diagnosis of EAHE has been excluded.
3. Once a diagnosis of EAHE has been established only hypertonic (3% or greater) saline solutions should be used for intravenous therapy.

Table 1: Symptoms of Dehydration¹²

- Excessive thirst
- Fatigue
- Muscle weakness
- Headache
- Dizziness
- Dry mouth, lips and skin
- No urination or a small amount of dark yellow urine
- Lightheadedness
- Increased body temperature
- Nausea
- Constipation
- Labored breathing

Is there a difference between bottled and tap water?

Objectively, bottled and tap water are equivalent products. Consumers have many reasons for choosing to drink one over the other, including taste, odor and appearance differences, health perceptions, mineral content (hardness), and as substitutes for other beverages.¹⁷ Another reason consumers may prefer bottled over tap water are concerns regarding safety. Bottled water companies have been observed to market their products as being “safer” than municipal water supplies. However, due to very stringent tap water regulations from the Environmental Protection Agency and the Food and Drug Administration, tap water is considered safer than bottled water.^{18,19}



Heavy metal toxicity has been a concern in the US, particularly in vulnerable groups, such as children. To ensure the safety of citizens, Congress passed the Safe Drinking Water Act in 1974. This act stated that contaminants in the water, ranging from heavy metals like lead and copper to microbial contamination, must be kept below levels that would result in harm to an individual. To protect water safety, pollution is regulated at many levels, including protecting the water source, treating the water, maintaining its distribution, and working to provide the public with up-to-date information about any changes in water safety.²⁰ These standards are not in place for private-use water sources, including bottled water.



Are there benefits or risks associated with sports drinks, alkaline water, and raw water?

Sports drinks, such as Gatorade®, have been advertised since the 1970’s as athletic hydration and carbohydrate replacement tools, and since that time, these have been marketed more broadly to the general public. Data from the 2010 National Youth Physical Activity and Nutrition survey of high school students indicate that 16 percent of these students consume one or more sports drinks daily, with students who are not active for >60 minutes daily more likely to consume these beverages. The American Academy of Pediatrics does not recommend the use of sports drinks for general hydration, citing plain water as being adequate to meet the needs of hydration, while not providing an excess of added sugar to the diet.²¹

Although sports drinks are typically marketed as superior hydration sources for athletes, the Institute of Medicine has found that evidence for this claim is lacking, and that studies done on the efficacy of sports drinks in trained athletes often contain conflicts of interest.²²

Both alkaline and untreated water (currently referred to as “raw water”) have more recently been introduced by the water industry. Alkaline water refers to water that is more alkaline, or basic, than typical tap or bottled water, with a pH of up to 8.8, rather than 6.7-7.4. The higher pH has been observed to permanently denature pepsin, and consumption of this product may be beneficial as part of a low-acid diet in treating acid reflux.²² It is marketed as a superior product for its proposed potential to support an ideal body pH, although health claims for this product are not currently supported by scientific literature.²³

Raw water is similar to bottled water, with the major difference being that it is marketed as being untreated, unfiltered, and unmodified in any way before being sold to the consumer.^{24,25} As this water comes from private sources, it is not subject to the same rigorous standards set in place for municipal water sources by the EPA. Consumers and raw water advocates do not report health claims associated with this product. However, due to the lack of safety regulations in place for this product, it is not recommended for consumption. Risks of consuming raw water include exposure to water-borne parasites and bacteria, which can cause severe illness.²⁶

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