



# Hydration

## Water and Electrolytes

*"If there is magic on this planet, it is contained in water."*

-Loren Eiseley

Most diets concentrate on the macronutrients: carbohydrates, fats and proteins. And for good reason, these are important. However, water, and the micronutrients it carries throughout our body, are equally, if not more important! The human body can survive for weeks without food, but only days without water. Just like our survival, our ability to function optimally depends more on hydration than it does on food.

When you look at the composition of the body, it is made up of approximately 25% solid matter, and approximately 75% water. The brain, arguably the most important organ of our entire being, is made up of approximately 85% water. Our blood is approximately 80% water, and our lean muscle is approximately 75% water.

Water plays a crucial role in nearly every bodily function and dehydration is the #1 reason for fatigue. Although water is not nearly as fun of a topic as sugars, fats, or proteins, it cannot be overlooked when aiming to reach optimal health!

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## DEHYDRATION

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With water being the largest component of the human body, you can image how important its role is in obtaining optimal health. Water creates our bodily fluids which aid in digestion, blood circulation, circulation of nutrients, absorption, and regulation of body temperature. When our body fluid levels become depleted, we run the risk of dehydration. Dehydration occurs when you use or lose more fluid than you take in, and your body doesn't have enough water and other fluids to carry out its normal functions.

Dehydration will:

- reduce the rate at which fluids are absorbed from the intestines which can lead to bloating and/or nausea,
- reduce our physical and mental performance,
- increases our heart rate and body temperature,
- increases the rate of our perceived effort during exercise,
- in extreme cases, can create a loss of coordination and impair our ability to make decisions.

Studies have indicated that a fluid loss of just 2% of the body mass is sufficient to cause a detectable reduction in athletic performance. That means, that for a 150 lb. athlete, a loss of 48 ounces of water (through sweat, vomiting, diarrhea, urination, breathing, spitting, blowing your nose, etc) can decrease that athletes athletic performance. To help you with a visual, the average athlete loses between 27-47 ounces (0.8-1.4 liters) of water per hour in sweat alone during exercise.

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## PROPER HYDRATION

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After we metabolize our macronutrients, our body transports them throughout the body with water. Water helps us remove toxins from the body. Proper hydration creates higher levels of oxygen in the bloodstream which increases your body's ability to burn fat stores.

Finding proper hydration balance is critical! If you under consume water, you risk dehydration. If you over consume water, you risk a condition called hyponatremia. Hyponatremia is a condition that occurs when the level of sodium in your blood becomes abnormally low. The over consumption of water causes a dilution of blood sodium levels. Symptoms of hyponatremia include:

- headache
- disorientation
- fatigue
- coma
- death (in rare cases)

### GENERAL RULES FOR BALANCING FLUID LEVELS

- Aim to drink 1/2 your body weight in ounces of water per day, preferably in small sips

### GENERAL RULES FOR BALANCING FLUID LEVELS DURING EXERCISE

- Thirst is not a good indicator of hydration status
- During exercise, drink at a rate that is comfortable
- Aim to replace 125-150% fluid loss after exercise within a 2-6 hour window



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## SWEAT

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Sweat is moisture that is excreted through the pores of the skin in reaction to heat, physical exertion, fever or fear. It is very similar in composition to blood. It is mostly water, but also contains minerals, such as sodium, potassium, chloride, magnesium and calcium, in varying concentrations. It is important to replace the fluid *and* minerals lost in sweat to prevent dehydration. During exercise, in most cases, sweat is lost at a greater rate than your intestines can absorb water and minerals, which creates a fluid deficit. Since this is the case, starting your workout well hydrated and replacing the fluids and minerals from the start, is critical to performance at your best and prevent dehydration.

### Factors that effect your sweat rate

- Environmental Factors- temperature, humidity, solar radiation, and barometric pressure
- Physiological Factors- metabolic rate, core temperature, skin temperature, and body mass.
- Other Factors- heat acclimation, clothing and air flow.

### How to calculate your sweat rate

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1. Empty your bladder. Weigh yourself before exercise or sauna with minimal clothes on.
2. Perform moderate exercise or sauna for a given number of minutes (15-60). Keep track of the ounces of water consumed during this time.
3. After exercise or sauna, towel off the sweat and re-weigh yourself with minimal clothes on.

Your weight loss reflects your fluid loss. For example, if you weighed 150 lbs to start, then weighed 148 pounds after 60 minutes of exercise, then your net weight loss (and therefore fluid loss) is 2 pounds (or 32 ounces fluid) per hour. This should be replaced (both water and minerals) within 2-6 hours after finishing exercise/sauna. If you consumed any water during the test, make sure to add that back into your calculation.

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## ELECTROLYTES

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Electrolytes are specific nutrients present in your body that have many important functions, such as regulating your heartbeat and allowing your muscles to contract so you can move.

It is the goal to replace the water and electrolytes lost in sweat as closely as possible to prevent dehydration and maintain normal function. To do this, we need to know what constitutes our sweat. Although the mineral content varies, the average contents of sweat are:

*1 Liter of water: 0.9g sodium: 0.2g potassium:  
0.015g calcium: 0.0013g magnesium*

**SODIUM-** Promotes carbohydrate and water uptake in the intestines and reduces the volume of urine post exercise. Both sweat and blood contain high concentrations of sodium. Therefore, if you under consume sodium, your body has no choice but to shrink your circulating blood volume to compensate. Same is true if you are a heavy sweater. You will loose higher amounts of sodium, and run the risk of your blood volume decreasing if it is not replaced. This will results in light headedness, sluggishness, and can even result in unconsciousness.

**POTASSIUM-** Helps control the frequency and degree to which our muscles contract. The kidneys favor sodium over potassium. Therefore, if you run low on sodium, your kidneys will give up potassium in exchange for retaining sodium. You can increase your potassium intake with daily food through meat and vegetables. 4oz of meat has the same amount of potassium as a medium banana.

**CALCIUM-** Plays a role in cell signaling, muscle contraction and nerve function. It is a critical mineral for

the muscles to be able to contract. If your muscles are unable to contract effectively (including your heart), you will have less than optimal workouts and poor muscle growth. You can find high amounts of calcium in kale, sardines, kefir and broccoli.

**MAGNESIUM-** Helps maintain normal nerve and muscle function by helping with the relaxation of muscles. If your body is running low on magnesium, your muscles (including your heart) will start to twitch. If left untreated, these twitches can turn into spasms (aka CRAMPS). You can obtain high levels of magnesium from dark leafy green vegetables.

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## HYDRATION DURING EXERCISE

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There are many over-the-counter beverages to consider when trying to replace your sweat loss during exercise. Not only are you aiming to replace the lost of water and minerals, but you may also be considering this beverage as a vehicle to provide your muscles with simple fuel. In this case, you must consider your body's ability to absorb these nutrients. Not only are you looking for a good tasting beverage, but one that maximizes gastric emptying and intestinal absorption, without causing GI distress.

**GASTRIC EMPTYING** refers to the rate at which food and liquid pass through the stomach.

**INTESTINAL ABSORPTION** refers to the rate at which the nutrients from the broken down food are absorbed across the lining of the small intestines (through active transport cells) into the blood stream. Note: water can move passively in either direction (through passive transportation) across the lining of the small intestine in response to osmotic pressure (always going in the direction of highest concentration).

Our small intestine is lined with active transport cells. These cells move molecules across the cell membrane from a region of lower concentration to a region of higher concentration. When looking at sugar transportation, we have 3 different transport cells that allow sugars to cross through the lining of the small intestines into the blood stream:

1. Glucose- simple sugar found in starches such as bread, rice and potatoes. Glucose suppresses the hunger hormone ghrelin and stimulates the satiation hormone leptin. Only 20% of glucose metabolism happens in the liver.
2. Fructose- simple sugar found in high fructose corn syrup, fruits, and honey. 100% of the metabolism of fructose happens in the liver. Fructose has no effect on ghrelin and interferes with your brain's communication with leptin, resulting in overeating.
3. Galactose ("milk sugar")- found in dairy products, sugar beets and other gums. Many people do not have the proper enzymes available to completely digest galactose. Therefore, it is a poor sugar choice for most people as it can easily cause GI distress.

During active transport of sodium and glucose into the blood, water is also pulled across the lining of the small intestines. Specifically, 2 molecules of sodium, and 1 molecule of glucose pulls 210 molecules of water with it. Therefore, if you want maximal absorption of sodium, glucose and water, an electrolyte sports drink with a moderate amount of sodium, and a small amount of sugar can increase the speed and amount of water absorbed. Alternatively, if you drink an electrolyte sports drink that is high in sugar, and low in sodium,

you will only absorb a small amount of water with it. For example, a 1,000ml sports drink with 1g sodium to 4g of glucose would only pull 100ml of water with it (that's only 10%!)\*

It has been suggested that an electrolyte sports drink with a 4-6% concentration (4-6g carbohydrate/100mL of water) is optimal for proper absorption.

Sports drinks are not recommended for an everyday hydration beverage. If your are daily movement or detox routine induces a higher than normal amount of sweat, an electrolyte sports drink might be ideal to replace lost fluids. Otherwise, filtered water with a small pinch of unrefined sea salt is optimal for day to day water consumption.

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## HYDRATION AND KETOSIS

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Many people who commit to a ketogenic diet go through a period of adaptation before they get to the euphoric feeling that you hear accompanies the diet. That adaptation phase can include something that has been coined the "keto flu." Don't worry, this isn't really the flu and you are not actually sick (although it can really feel like it). This is a natural reaction your body undergoes as it switches from burning sugar to fat for energy. So what is causing these flu-like feelings? You guessed- the loss of electrolytes (specifically sodium) and water. Insulin has many roles in the body, but one of them is to signal the kidneys to retain water and sodium. When that signal goes away from a diet low in carbohydrate, the kidneys also begin to dump sodium and water. You might notice an increase in urination, and also a screaming headache. Don't panic, just be overly mindful about drinking filtered water with unrefined sea salt to cure your "flu."



# HOMEWORK

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## Part 1: Sweat Rate Test(s)

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We have already established the need to sweat every single day (remember, this is one of the 3 “P’s” of detoxification). Your homework is to complete at least one sweat rate test. If you have a movement routine, I highly encourage you to do this multiple times to see how different conditions and types of efforts can affect your sweat rate. If you have a detoxification routine that includes sauna treatment(s), you should conduct a sweat rate test for this also. Things to consider/test:

- How does your sweat rate change from summer to winter?
- How does your sweat rate change from indoors to outdoors?
- How easy is it to replace your fluid loss after sweating?

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## PART 2: BASIC HYDRATION

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You already spent time in module 2 (detoxification) tracking your water intake. Now that you know your general sweat rate, it is time to track again! Can you consume 1/2 your weight in water in ounces daily in small sips throughout the day AND replace 1 1/2 times your fluid loss within 2-6 hours of sweating???

The fluid you replace from sweat loss during sauna treatment and/or exercise DOES NOT count as part of your daily hydration needs.