

Fact checking pHony water

By Nicholas Staropoli — July 30, 2015

An old, and weakened Mahatma Gandhi went 21 days without eating. Other reports have humans living as many as 40 days without food. But to go this long without food, people still have to consume water. [Seven days](#) [1] is believed to be the most a person can go without water, but some estimates put that length at closer to three. We are 60 percent water and we need to keep it that way by consuming as much as 4 liters of fluid a day.

Water is the main component of our blood which allows us to transport waste and nutrients throughout our body. Some cell types are as much as 75 percent water. Historically humans set up settlements in places where they had easy access to drinking water. [There are numerous charities set up that focus on bringing clean, potable water to people](#) [2]. But water isn't just the sustenance of life for humans, this is true for all life. Our planet is 75 percent water and as much as 80 percent of all [life on Earth is found in water](#). [3] When we go looking for life on other planets, water is one of the first characteristics we look for.

Water is a big freaking deal.

It's important that we get enough of it and it's important that what we drink is clean and safe. But lately there have been claims that water needs to be of a high pH (alkaline) to be healthy.

By definition water is supposed to be pH 7 (neutral, not an acid or a base) but alkaline water advocates and companies claim that alkaline water can help your body stay properly hydrated and that it provides a source to superior hydration.

Is it true? Since these claims lack citation, I went searching for the truth about alkaline water.

First I looked into whether the alkaline water actually was better for you and then I looked into whether the reported pHs on the bottles of three alkaline waters were accurate and tested them at Columbia University.

First, what is pH?

In general, pH is a measure of hydrogen content in a system. It is determined by taking the inverse log of the concentration of the free hydrogen ions in a solution. The important thing to realize from this definition is that pH is a logarithmic scale meaning a pH change of 1 (say from 3 to 4) is actually a ten fold difference in acidity. Bases are molecules that can decrease the amount of free hydrogen ion when added to a solution. A pH of seven is considered neutral, while a pH above this number is considered alkaline (or basic) and a pH below neutral is considered acidic. Pure water has a pH of seven. At both ends of the pH scale, the solutions can be dangerous to humans.

Physiology

The pH of your body is vital to its normal functioning and to maintaining homeostasis. This is true of all organisms. Proteins, a class of biomolecules that includes everything from hair to hormones, are very susceptible to changes in pH. Their structure is fluid across the pH scale, which is significant because proteins rely on their structure to perform their function. Even a slight change in pH can change a protein structures enough to diminish its efficiency, which can lead to adverse physiology for the organism.

This is why pH is tightly regulated around the body with many different mechanisms to make sure pH stays constant. The main way is through the bicarbonate buffer system that exists in your blood. In biochemistry, buffers are systems that strongly resist changes in pH despite the addition of acidic or basic chemicals. A well designed buffer system, like the one in our blood, will keep a tight pH range despite the addition of large amounts of acidic or alkaline chemicals.



The above equation describes the the bicarbonate buffer system in our blood. In a buffer system at equilibrium, according to what is called Le Chatelier's principle, when something is added to one side of the equation, the system responds by producing more of the chemicals on the other side until the equilibrium is restored. CO₂ is a large part of this system for humans, altering respiratory rate affects the system by adding or eliminating CO₂. If the blood gets too acidic, a condition called acidosis, respiratory rate increases to bring the pH back up, and if the blood gets too alkaline, called alkalosis, respiratory rate can decrease so more CO₂ can dissolve into the blood. This system allows the body to keep pH of blood between 7.35 and 7.45. There is 5 L of blood at this pH, so adding 12 ounces of pH 9 water is highly unlikely to affect this system in any meaningful way. In fact if it did we would be in trouble, as many of the things we drink (e.g. orange juice) have much larger pH differences from our blood. The pH of the extracellular space is also kept around this pH by a similar mechanism.

Other parts of the body have more drastic pHs. The skin for instance maintains a pH of around 5 through secretions from sebaceous (oil) glands. Keeping this acidic pH has a variety of immune functions including keeping bacteria, viruses and funguses from entering the body, but it is also [important for keeping the normal flora on the skin](#).^[4] In essence, the acidic pH of the skin keeps the normal flora in check, allowing it to exert its beneficial effects without allowing these organisms to become pathogenic.

Another place where an acidic pH is important is the stomach, where specialized cells keep the pH at the dangerously low (at least for the rest of the body) value of 2. This is important for the digestion and inactivation of proteins from food.

This is where the case for alkaline water having any influence on your health really breaks down.

Any food entering the stomach is acidified by these gastric juices. Furthermore, when leaving the stomach, the pancreatic secretions into the small intestine immediately change the pH to a range

of 5-7.

The water's pH will drop as it enters these very acidic environments. Any reported health effects would be lost in the stomach. But if by some chance it was not fully acidified by the stomach it would actually be very detrimental to digestion which relies on the low pH to do a tremendous amount of digestion of food so nutrient extraction can occur further along the alimentary canal. Furthermore, many enzymes are not activated until they interact with the low pH of the stomach and intestines. The medical term for elevated stomach pH is hypochlorhydria and has a whole host of negative pathologies. No studies to date have been performed to determine if alkaline water can cause hypochlorhydria but if these companies are right that their water alkalizes your body it might be very dangerous to your health.

Testing the alkaline water products

We decided to test three waters that made claims of alkaline pH: [Pure blue](#) [5] (pH 8.5), [Iceland spring](#) [6], and [Essentia](#) [7] (pH 9.85). As a control we tested NYC tap water which came in at 6.5. Here is what these companies claim their alkaline water does:

Pure Blue

Health claims: Diet and stress can wreak havoc on the body and cause weight gain and other health concerns. Alkaline water neutralizes acidity, supports pH balance and tastes great.

Science: This says some flowery things but lacks substance. Claiming diet can cause weight gain is not revolutionary, nor does it have much to do with calorie-less water. The alkaline water neutralizing acidity is true but as I stated before, acidity is beneficial and necessary for normal physiology and digestion. Finally it supports pH is baseless as pH balance in blood and fluids is ten times below the pH of Pure Blue's water.

Lab tested pH: 7.92

This is 5 times less alkaline than promised!

Iceland spring

Health claims: The slightest change on the acid/alkaline scale can have disastrous results on the body. By drinking Iceland Spring Water with a pH level of 8.88 you can help your body maintain a healthy pH level by reducing acidity in your body and restoring its natural balance.

Science: It is true that slight changes can have disastrous effects on your body. But this is in direct contradiction to second sentence where they tell you a pH over ten times more alkaline than your blood will restore its natural balance.

Lab tested pH: 7.64

Over ten times less alkaline than promised!

Essentia

Health claims: The Japanese Ministry of Health and Welfare has certified that alkaline electrolyzed water is a beneficial remedy for gastrointestinal disorders such as chronic diarrhea, constipation, gastrointestinal fermentation and poor digestion. It should be noted that in addition to the pH factor, the energy in the water (which would not be affected by the stomach acid) could be another factor to explain health benefits in the GI tract.

Science: [It is possible and one cell culture based study found that gastric reflux disease](#) ^[8] (results from having a stomach pH that is too acidic) might be helped by alkaline water, but that would make this water only beneficial for a select few with this condition. The energy in the water is pure quackery. Furthermore, they frequently go out of their way on the site to point out there is no fluoride in their water. Apparently, they missed all the science on the benefits of fluoride on oral hygiene.

Lab tested pH: 9.85

Essentia actually claims 9.5 or higher so this one checks out as true but for perspective here are some other chemicals with that pH: sodium barbital, toothpaste and milk of magnesia.

Why is alkaline water suddenly a fad?

The evidence supports the idea that alkaline water is a sham, on par with the gluten free fad. So where did it come from? [For a long time the pseudo-science](#) ^[9] crowd has been pushing an idea that cancer is a disease of acidic lifestyle. They maintain that low pH foods cause cancer and that by ingesting a high pH diet you can kill the cancer cells with high alkalinity.

There is zero scientific evidence that supports this idea. Drinking water will hydrate you but it won't cure your cancer.

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Links

[1] <http://www.businessinsider.com/how-many-days-can-you-survive-without-water-2014-5>

[2] <http://www.goodnet.org/articles/1000>

[3] <http://marinebio.org/marinebio/facts/>

[4] <http://www.ncbi.nlm.nih.gov/pubmed/18489300>

[5] <http://www.drinkpurebluewater.com/>

[6] <http://www.icelandspring.com/>

[7] <http://www.essentiawater.com/>

[8] <http://www.ncbi.nlm.nih.gov/pubmed/22844861>

[9] <http://scienceblog.cancerresearchuk.org/2014/03/24/dont-believe-the-hype-10-persistent-cancer-myths-debunked/>