

Drinking Water Hardness and Your Health

Hard water is caused by high concentrations of certain types of minerals, mostly certain forms of calcium and magnesium, in drinking water. Calcium and magnesium are most often imparted to water by the natural interaction of groundwater with limestone and dolomite that contain these minerals, and thus groundwater is generally harder than surface water. Calcium and magnesium are naturally occurring minerals that play vital functions inside the human body.

The minerals in hard water interact with soap to form characteristic soap scum instead of desirable lather (foam) and also produce scale deposits on the inside of pipes and heat exchangers; this scaling can, over time, impact the performance of household and regional plumbing.

In the United States, legal limits for the levels of certain contaminants in public drinking water are adopted by the Environmental Protection Agency (EPA) on the basis of evidence that the contaminants impact human health in negative ways. These standards are called Maximum Contaminant Levels (MCLs). Public drinking water is regularly tested for the presence of all kinds of contaminants like lead, arsenic and other substances known to be harmful to human health. For other contaminants that impact water in aesthetic or functional ways (for example, by fouling plumbing or appliances), the EPA may set an advisory level called a National Secondary Drinking Water Regulation (NSDWR). Public water utilities are not required to meet these standards as they do not relate directly to human health.

There are no MCLs (standards that protect human health) relating to total hardness, calcium or magnesium. This is because the available research does not show a clear connection between hard water and health problems. In 2013, a review of available research concluded that "hardness is important for drinking water from the point of view of both aesthetic acceptability and operational considerations," but that "there are insufficient data to suggest either minimum or maximum concentrations of minerals." The research reviewed in this report does suggest that people who drink water that is deliberately demineralized should consider adding calcium and magnesium salts post-treatment because drinking water can be an important source of these minerals in the diet.

According to a 2011 World Health Organization (WHO) report, otherwise healthy people who consume too much calcium are protected from health effects by the interaction of vitamin D and excess calcium in the kidney. Calcium that is beyond what is needed by the body is simply excreted out in urine. There is some concern in the report about individuals with kidney problems, where this self-regulating mechanism is degraded. This conclusion generally holds for magnesium consumption as well, though severely increased magnesium intake may cause short-term diarrhea. In short, people with proper kidney function and no other health conditions that affect the body's interaction with calcium and magnesium are unlikely to have any negative health effects from drinking hard water.

Furthermore, there are no NSDWRs (voluntary standards that protect aesthetics and water system function) for total hardness, calcium or magnesium. This is because the formation of scale and soap scum are dependent on many more factors than just total hardness or the concentration of calcium or magnesium, so it is difficult to translate a particular level into an advisory level for water systems and users. The WHO report acknowledges that water containing calcium carbonate at concentrations below 60 milligrams per liter (mg/l) is generally considered as “soft;” 60–120 mg/l, “moderately hard;” 120–180 mg/l, “hard;” and more than 180 mg/l, “very hard.”

Both users of public and private water can order water hardness testing if there is a concern that the water is hard, if it is difficult to form soap lather, or if users observe scaling on pipes and fixtures. Commercial water softeners are capable of removing hardness-causing minerals through a process called “ion exchange;” testing is the first step to selecting the best softener for your well system. SJBPH further recommends that consumers who soften their water and/or further treat it with reverse osmosis speak to their primary care physician about maintaining the proper level of dietary minerals, especially calcium and magnesium, in their body. All testing should be done via a laboratory certified to perform the appropriate testing by the Colorado Department of Public Health and Environment.

Though private well users may wish to test for water hardness, it is far more important to test private wells for contaminants that are known to cause health problems. For public water system customers, this testing is done for you by your water system operator, but for private well users, the responsibility to maintain the safety of the water falls on the well owner. SJBPH recommends that every private well user test their well annually for coliform bacteria, including *E. coli*, and for nitrate and nitrite. SJBPH further recommends that, if a well has never been tested or its testing history is unknown, well users do a one-time test for arsenic, lead, and fluoride. All testing should be done via a laboratory certified to perform the appropriate testing by the Colorado Department of Public Health and Environment.

Sources of Information:

Cotruvo, Joseph, et al. *Hardness in Drinking-water: Background document for development of WHO Guidelines for Drinking-water Quality*. World Health Organization (2011). Available at https://www.who.int/water_sanitation_health/dwq/chemicals/hardness.pdf.

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