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WATER AND ITS IMPACT ON HEALTH

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INTRODUCTION

The role of water is continuing to gain recognition for its importance in health and disease. Not only can organic contaminants, such as chlorinated hydrocarbons, insecticides or toxic heavy metals have adverse health consequences, but nutritional mineral dominance or relative ratio imbalances found in the water supply may also have a profound effect, depending upon the susceptibility of the individual consuming it.

Why some people are susceptible and others are not can be explained by individual metabolic characteristics. These include, nutrient mineral status, metabolic utilization, absorption capabilities and retention rates, in relation to the mineral content of the water being consumed.

Note: The U.S. Environmental Protection Agency has established drinking water standards for nutrient mineral and toxic metal content. However, detrimental and/or favorable effects have been cited with mineral levels occurring well within these acceptable ranges.

Soft water, sodium and cardiovascular disease

Soft water is characterized as being acidic (pH less than 7.0), with total hardness in the range of less than 180 mg/L. The relationship of soft water influencing the incidence of cardiovascular disease death rates was first documented in 1957. Since then, other studies have confirmed that death rates from cardiovascular disease were significantly higher in areas with soft water, as compared to hard water regions.

Sodium may be a main contributor to various health disturbances found in soft water regions. A high sodium level or high sodium in relation to other specific minerals is frequently found occurring naturally in soft water. The process of artificially softening water will also result in elevated sodium levels relative to calcium and magnesium. Treated or softened water usually does not raise the sodium content above acceptable ranges, however, the sodium concentration can be over one-thousand times higher in relation to calcium and magnesium levels. Susceptible individuals, or those who have a tendency to retain sodium, would be adversely affected by consuming water with high concentrations of sodium (real or ratio-wise).

Calcium and magnesium

The minerals calcium and magnesium are known to prevent increased sodium accumulation within the body. Intake of water containing excess sodium however, can contribute to calcium and/or magnesium deficiencies systemically. This is especially true if dietary calcium or magnesium intake is marginal or inadequate.

Calcium produces a stimulatory or hyper excitable effect upon muscle tissue, while magnesium produces a sedative effect. A magnesium deficiency relative to calcium will produce vasoconstriction. Magnesium has been generally accepted as being the protective factor in preventing cardiovascular disturbances, due to the beneficial effects of magnesium when administered during the treatment of cardiovascular disorders. Heggvelt and co-workers reported that magnesium levels in infarcted myocardial tissues averaged 42 percent less than in non-infarcted cardiac tissue. Other studies have also reported that levels of magnesium are higher in the cardiac tissue of individuals who had lived in hard water areas and who had died of accidental causes as compared to heart attack victims.

Zinc-to-copper balance and ischemic heart disease (IHD)

The zinc-to-copper relationship should also be scrutinized, in both hard and soft water. Evidence presented by Dr. Leslie Klevay has shown that a high serum zinc-to-copper ratio, or a relative copper deficiency may contribute to IHD. A deficiency of copper relative to zinc can cause a decrease in HDL (high density lipoproteins). An elevated tissue zinc-to-copper ratio (17 to 1 or greater) would indicate susceptibility if water with this same mineral configuration is being consumed.

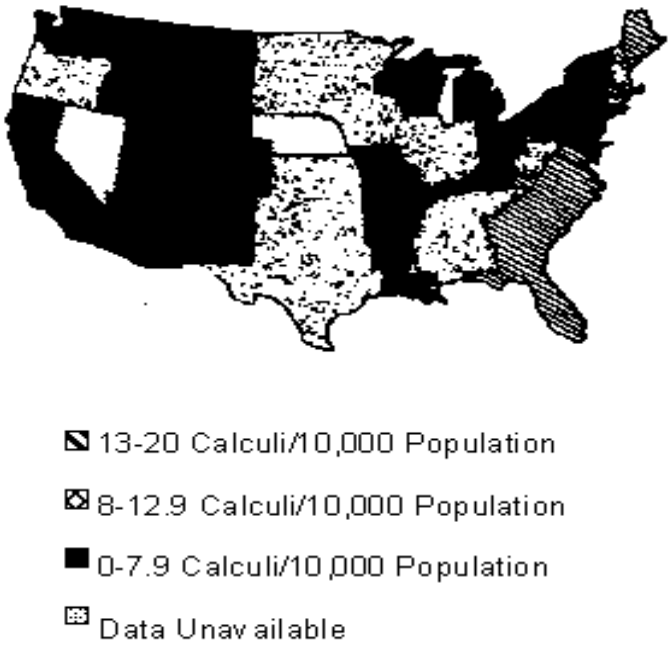
A low zinc to copper tissue ratio can also contribute to atheromatous development. Excess tissue copper accumulation is known to have a suppressing effect upon the thyroid gland. Hypothyroidism has long been associated with elevated serum cholesterol.

Excess copper is frequently found in soft water, due to the corrosive effect of soft water acidity upon copper pipes. If substantial amounts of copper are being leached from the pipes, it is readily evident by the deposit of copper sulfate in the sinks. A bluish green discoloration will develop if the water drips from the faucet overnight.

Chlorine and ischemic heart disease (IHD)

The chlorine content of water may also be a factor to consider in heart disease. Studies reported by the E.P.A. (using pigeons as model), found that cholesterol levels increased in the group drinking chlorinated water while on a low calcium diet. This group exhibited a fifty percent increase in cholesterol over the control group. Calcium intake was found to prevent this rise in cholesterol, even when chlorine and fat were present in the diet.

Chlorine is used as a disinfectant in drinking water and may range from one to three milligrams per liter. Even though the water in the animal studies contained ten milligrams per liter, a susceptible individual may be affected by chlorine in much smaller amounts.



Incidence of urinary calculi requiring hospitalization in 1952 (From Boyce et al., 1956, and Landes et al., 1977.)

The studies are continuing, and at present they indicate that hard water (high calcium and magnesium), as well as a diet adequate in calcium may hinder atherosclerosis when chlorine is present. These studies would also suggest that patients suffering from IHD avoid chlorinated water. Individuals with health problems prone to atheromatous formation, such as hypothyroidism, diabetes, hypercholesterol and hypertriglyceridemia should also be cautioned.

Recent studies have also shown evidence that links chlorinated water supplies to an increased incidence of colon, rectal and bladder cancer. This is apparently due to the interaction of chlorine with other chemicals in the water, producing carcinogens.

TOXIC METALS

Mineral assays of soft water will frequently reveal concentrations of toxic metals above acceptable E.P.A. levels. These include, copper, lead, manganese and cadmium. The high concentration of toxic metals is usually due to the corrosion of water pipes, soldered joints and faucets used in the home. Increased amounts of toxic metals in water can contribute to an increased body burden of these metals, especially in children and the elderly, with subsequent increases in adverse manifestations.

Lead

Lead content in water will tend to be higher in areas of soft water and lower in hard water areas. Lead concentrations of water in the Boston area, reported in a 1981 study, were found to be above E.P.A. standards in fifteen percent of the homes tested. The average pH of Boston

water ranged between 6.0 and 7.0 with a hardness of 14 mg/L., as compared to water tested in the Columbus, Ohio area, in which the pH was 9.6 with a hardness of 101 mg/L.

It has been shown that lead concentrations can be dependent upon how long the water has been standing in contact with the pipes, soldered joints and faucets. Lead concentrations will increase as the duration of time the water is exposed to pipes and joints increases. Normally, concentrations will decrease after a five-minute flush, and will again reach these previous levels by the mid-afternoon. This reflects the effect to which soft water leaching may have upon increased toxic metal tissue concentrations in individuals, such as with the heavy metal lead.

Cadmium

Cadmium has been implicated in cardiovascular disease and renal dysfunction. Dr. Henry Schroeder found that cadmium in the drinking water was the most effective of the heavy metals in producing hypertension, heart enlargement, atherosclerosis and kidney disease in animals. These manifestations resembled those problems seen in humans. Cadmium has a tendency to accumulate in the kidneys, arteries and liver. It also competes with the mineral zinc, resulting in an interference with zinc related enzyme functions. Dr. Schroeder stated that the zinc-to-cadmium ratio naturally occurring in the earths crust is between 500 and 1000 to 1. We have established the ideal zinc to cadmium tissue levels at 500/1. At this ratio or higher, zinc is protective to the adverse affects of cadmium. Drinking water should have at least a 300/1 ratio of zinc-to-cadmium to be considered safe for consumption.

METABOLIC DISORDERS

Osteoporosis

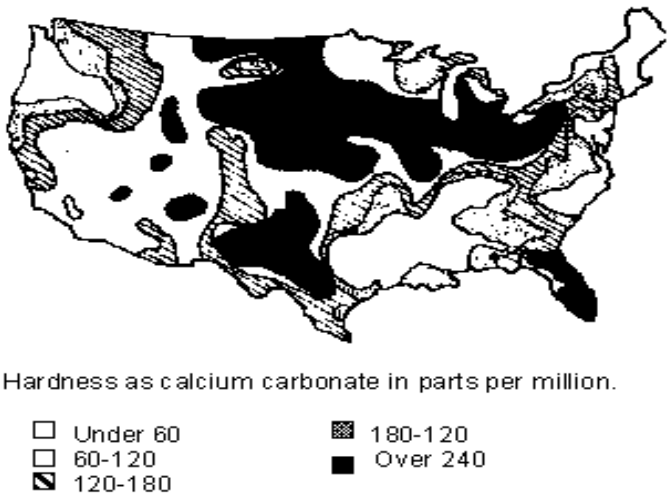
Prolonged intake of soft water can contribute to osteoporosis, especially in individuals with a predisposing systemic mineral pattern. Water containing inadequate amounts of magnesium relative to calcium has been shown to be related to a greater incidence of bone fractures with decreased healing time of bones in the elderly. Magnesium deficient soils and water have also been related to osteoporosis and dental caries, even while the calcium content is adequate or high. It is recognized that a high calcium to magnesium ratio results in decreased bone matrix formation.

Hypertension and arthritis

Drinking water that contains high amounts of iron can lead to excess tissue deposition. The primary deposition sites are in the liver, joints and muscle. Excess accumulation is associated with arthritis, cirrhosis and hypertension.

Hyperactivity

Elevated lead accumulation has been well documented in contributing to hyperactivity in children, as well as other intellectual deficit disorders. Children are very susceptible to lead retention. This has been seen consistently in tissue mineral patterns, in which the majority of children show low calcium tissue levels, or low tissue calcium-to-lead concentrations. Calcium intake in adequate amounts is necessary to protect from the highly detrimental effects of lead and its absorption. When calcium intake is below ideal, lead is readily absorbed and will be deposited similarly and in place of calcium.



Source: Reproduced with permission from Water Atlas of the United States, (Syoset, N.Y., Geraghty and Miller, Inc.)

Premenstrual syndrome

With the increased use of copper pipes and soft water systems in homes today, excess copper accumulation in the tissues is now found more frequently in a greater percentage of the population. Perhaps the most susceptible population group is women. Copper toxicity or a relative zinc deficiency has been found in women suffering from PMS and emotional disorders. Elevated tissue copper accumulation contributed to by oral contraceptive agents and copper IUD's, and further added to from water sources can contribute to a significant copper burden.

Kidney stones

Soft water areas of the United States have also been correlated with an increased incidence of renal calculus formation. Again, this condition is related to magnesium deficiency, relative to calcium. The increased consumption of soft water during the summer months and increased vitamin D synthesis due to exposure to sunlight, increases the amount of calcium absorption resulting in a relative magnesium deficiency. This may explain the seasonal occurrence of kidney stone formation during the summer months.

Hard water

Hard water is usually characterized as having a pH greater than 7.0, with total hardness in the range of 250 mg/L or greater. Since most adverse health affects appear to be contributed to by soft water, it would seem logical that hard water is ideal for everyone. However, hard water can also contribute to mineral deficiencies, or imbalances. As an example, excess calcium can antagonize the absorption of other minerals, such as iron, zinc and potassium. Studies have indicated that zinc can be negatively affected by the consumption of hard water, but less so than with the use of soft water.

APPLICATION OF LABORATORY RESULTS

Hair tissue mineral analysis (HTMA), in conjunction with elemental water assays can be applied in the clinical practice to expose the detrimental or therapeutic effects of water that is presently being consumed. If a patient is not responding favorably to therapy for seemingly unknown reasons, we suggest that you check their water supply. The water source could be a contributing factor for their lack of response. Water with the correct mineral patterns and pH, may then be added to aid or enhance response to the nutritional therapy.

In comparing hundreds of water mineral results to the patients HTMA profiles, the following conclusions can be drawn. Generally speaking, individuals showing low tissue calcium and magnesium levels in relation to high sodium and potassium, should avoid soft water, or water that has been artificially softened, especially if the patient is subject to hypertension, or IHD. Hard water would be considered therapeutic or protective for these individuals. Individuals who have HTMA patterns, which reveal high levels of calcium and magnesium on a hair tissue mineral analysis, relative to sodium and potassium may benefit from the use of soft water.

HARD WATER

Indications for hard water based on Hair Tissue Mineral Analysis:

Hard water may be therapeutic if HTMA results reveal:

Ca/P < 3.0/1 and
Na/Mg > 5.0/1 and
Ca/K < 4.0/1 or
Ca/Na < 1.5/1

SOFT WATER

Indications for soft water based on Hair Tissue Mineral Analysis:

* Soft water may be therapeutic if HTMA results reveal:

Ca/P > 3.0/1 and
Na/Mg < 4.0/1 and
Ca/K > 4.0/1 or
Ca/Na > 1.5/1

Does not necessarily indicate the need for use, but only implies consumption is not prohibited.

If either hard or soft water is considered therapeutic according to the applicable preceding ratios, then the following water mineral levels and ratios should be reviewed and evaluated. In correlation with HTMA results, these water ratios can indicate the need to reduce or omit completely the patient's current water source.

WATER MINERAL RATIOS	HTMA RATIOS AND/OR LEVELS
Column A:	Column B:
Ca/Fe < 800/1	Ca/Fe < 14.0/1 or Fe > 4.0 mg%
Ca/Mn < 5000/1	Ca/Mn < 250/1 or Mn > 0.25 mg%
Fe/Cu > 0.6/1	Fe/Cu > 1.5/1 or Cu < 1.3 mg%
Fe/Cu < 0.2/1	Fe/Cu < 1.0/1 or Cu > 5.0 mg%
Zn/Cu > 8.0/1	Zn/Cu > 17.0/1 or Cu < 1.0 mg%
Zn/Cu < 5.0/1	Zn/Cu < 6.0/1 or Cu > 5.0 mg%

Note: If the water analysis reveals a mineral pattern that corresponds with any one of the ratios in column A in addition to the respective column B HTMA ratio and/or level, the water source should be avoided or reduced during therapy.

ACCEPTABLE TOXIC WATER RATIOS

1) Ca/Pb > 10,000/1
2) Fe/Pb > 20/1
3) Zn/Hg > 2500/1
4) Fe/Hg > 250/1
5) Zn/Cd > 300/1

Note: If the water test results show an elevated toxic metal above the E.P.A. limit, it should not be consumed. If the levels are within limits, but any of the preceding toxic water ratios are less than what is noted, it is recommended that the water source be avoided as well.