

POINT-OF-USE

Water Quality Report for Consumers

A Joint Publication with the Water Quality Association

Volume 2, No. 2, 1987

Sodium You Drink: A Balanced Perspective

The relationship between sodium in the water you drink and your health isn't a simple matter of cause and effect. Generally, only about 6% of the sodium in your daily diet comes from drinking water with a hardness level of 15 grains.

According to experts at the Water Quality Association, most water contains some natural sodium, which can vary from a few milligrams to several hundred milligrams per quart. Sodium is also used in the water softening process to remove hardness minerals from water. However, for most average healthy individuals, the small amounts of sodium added by water softening does not present any adverse health effects.

"For those individuals on a medically-supervised sodium-restricted diet, we do recommend having the softener bypass the kitchen cold water line or installing a drinking water system to reduce the sodium in the water," advises Lucius Cole, Technical Director for the Water Quality Association.

Two popular home water treatment methods used effectively to reduce sodium in drinking water are reverse osmosis, the result of water being forced through a semi-permeable membrane rejecting most suspended and dissolved matter in the water, and distillation which converts water into vapor by heating.

Cole advises individuals on low-sodium diets to check labels for sodium content of foods since many products are now carrying nutritional information voluntarily.

For those on a "normal" diet, Cole says that the amount of sodium added during the softening process is extremely small compared to other sources of sodium in the diet.

DIET CONSIDERATIONS

A minimum recommended daily intake of sodium in the human body has not been authoritatively established. The Committee on Sodium Restricted Diets and the Food and Nutrition Board of the National Research

Council indicated that the "habitual total (daily) intake (of sodium) of 3000 to 4000 milligrams . . . " The publication also indicated that a mild sodium restricted diet consists of less than 2000¹ milligrams/day. However, there is a very small special risk group of people who are highly sensitive to sodium and must be on a severe sodium restricted diet of 500 milligrams per day. The National Research Council has stated "Adverse health effects may be anticipated with sodium concentrations in water greater than 20 mg/L only for that special risk group restricted to total intake of 500 mg/day, because intake from food cannot be reduced feasibly to less than 440 mg/day."¹ The same document goes on to say that this low sodium diet is virtually impossible without hospitalization.

Researchers over the past few years have attempted to correlate a relationship between natural soft water and cardiovascular disease. These epidemiological studies have been inconclusive. Naturally soft water contains a very small amount of calcium and magnesium with varying amounts of other minerals such as sodium. Artificially softened water has never been implicated in these studies. A U. S. EPA sponsored symposium "Conference on Inorganic in Drinking Water and Cardiovascular Disease" was held in 1984 at the University of Massachusetts. A summary of this worldwide meeting indicated unequivocally that

there was no casual relationship between softened drinking water and cardiovascular disease. The U. S. EPA does not regulate sodium in drinking water. EPA suggests a guidance level² of 20 mg/1 in drinking water for the high risk population under severe sodium restriction (500 mg/day).

The effect of sodium alone on hypertension has not been established. For example the results of five recent important independent studies³ on both humans and laboratory animals suggests that sodium may *not* be a factor in hypertension unless it is associated with chloride ion. In the water softening process hardness ions (calcium and magnesium) are exchanged on the resin bed for sodium ions which enter the water supply. There is no addition of chloride ions. Most of the sodium is in the form of sodium bicarbonate which, according to these studies, would have no effect on hypertension.

Regardless of these recent developments, the amount of sodium obtained from drinking softened water is insignificant compared to the sodium ingested in the normal human diet. The amount of sodium introduced to a quart of drinking water by softening vary hard 18 grains per gallon water is approximately 140 milligrams. If an individual consumes one quart of water per day, this sodium intake is less than 5% of the average daily intake. (Continued on other side)

| Initial Water Hardness/Grains Per Gallon | Milligrams Na+ Per 3 qts. Softened Water | Milligrams Na+ from Food | Total Na+ Consumed Milligrams | % of Total from Softened Water |
|--|--|--------------------------|-------------------------------|--------------------------------|
| 1 | 22 | 5,000 | 5,022 | 0.4% |
| 5 | 111 | 5,000 | 5,111 | 2.2% |
| 10 | 222 | 5,000 | 5,222 | 4.3% |
| 15 | 336 | 5,000 | 5,336 | 6.3% |
| 20 | 447 | 5,000 | 5,447 | 8.2% |
| 30 | 669 | 5,000 | 5,669 | 11.8% |

Sodium You Drink

(Continued on other side)

An 8 oz. serving of this water would contain 35 milligrams of sodium, considered "very low sodium" by FDS in their new regulation on nutrition labeling of sodium content.⁴

To measure the sodium content of your drinking water, Cole suggests contacting your local water company or a certified water quality improvement specialist or dealer. "If you are on a well, you can arrange to have an independent laboratory test a sample," says Cole.

If you want to learn about this subject, you may want to check a few of the hundreds of articles and references available. Several are included here:

1. National Academy of Sciences, The National Research Council, *Drinking Water and Health*, 1977, p. 436.

2. *Federal Register*, Vol. 45, No. 168, August 27, 1980, p. 57336.

3. Morgan, T.O., *The effect of potassium and bicarbonate ions on the rise in blood pressure caused by sodium chloride*, *Clinical Science* (1982) 63, pp. 407s-409s.

Kurtz, Theodore W., and R. Curtis Morris Jr., *Dietary Chloride as a Determinant of "Sodium-Dependent" Hypertension*, *Science*, Vol. 222, December 9, 1983, pp. 1139-1141.

Husted, Frederick C. Karl D. Nolph, and John F. Maher, *NaHCO₃ and NaCl Tolerance in Chronic Renal Failure*, *The Journal of Clinical Investigation*, Volume 56, August, 1975, pp. 414-419.

Kotchen, Theodore A., M. D., et al., *Effect of Chloride on Renin and Blood Pressure Responses to Sodium Chloride*, *Annals of Internal Medicine*, 1983 (Part 2), pp. 817-822.

McCarron, David A., Cynthia D. Morris and Clarice Cole, *Dietary Calcium in Human Hypertension*, *Science*, Vol. 217, July 16, 1982, pp. 267-269.

4. *Federal Register*, Vol. 49, No. 76, April 18, 1984, p. 15518

For a free six-page booklet on sodium which includes commonly asked questions and answers pertaining to sodium in water and your health, send a self-addressed stamped envelope to: Water Quality Association, Dept. R-25, 4151 Naperville, Lisle, IL 60532.

Consumers Ask...

Q. I am on a sodium-restricted diet but still want to enjoy the benefits of soft water. Is there any way I can do both?

A. There are two ways to satisfy your drinking and softened water needs. Individuals who are on Medically-supervised sodium-restricted diets can have the water softener installed with a bypass for the cold water tap in the kitchen. If you do

Not want hard water for even that single tap, you may want to consider installed a reverse osmosis or distillation drinking water system. Both technologies effectively reduce the sodium in the water as well as produce a generally high quality drinking and cooking water. They can be connected to a separate "third" faucet in the kitchen, several faucets and even plumbed to your refrigerator ice maker. Both systems work more effectively on softened water but can be used virtually anywhere.

Soft Water Savings For Water Heaters Cited By Battelle Study

Good news for consumers on soft water was presented in the final results of a four-year study conducted by Battelle Columbus Division on "The Effect of Water Quality on Residential Water Heater Life-Cycle Efficiency". The Battelle study determined that efficiency savings exist on water heaters when using softened water which reduces scale build-up.

Battelle's findings confirm results of a 1983 study sponsored by the Water Quality Research Council and conducted by New Mexico State University. That earlier report cited on approximate 29% savings for gas water heaters and 21% for electric units when using softened water.

Final Results

The final results of the Battelle study, which was conducted in four U. S. cities for the Gas Research Institute, found that the build-up of scale deposits gradually reduces the heating efficiency of gas-fired water heaters. Effects on electrically heated units were not quite as dramatic. Results also found that the various treated waters used in the study were generally less corrosive to the common plumbing materials of steel, galvanized steel, copper, and brass than hard water.

In September 1982, Battelle engineers began monitoring the long-term cyclic performance of 48 water heaters under

Controlled laboratory conditions in four U. S. cities. The intent was to determine the effects of scale build-up in gas and electric residential water heaters, and the benefits and limitations of common water treatment methods.

"The Battelle study determined that efficiency savings exist on water heaters when using softened water which reduces scale build-up."

Test sites were located in Columbus, Ohio; Lisle, Illinois; Marshall, Minnesota; and Roswell, New Mexico.; Battelle chose these areas primarily because of their scale-forming hard water supplies. Each testing site was used between 12-16 months for the four-year study.

Final results of the study were based on data from all four testing locations. During the last year of the study, four of the original six gas-fired water heaters were kept in operation at the Columbus, Ohio test site to confirm all collected data.

Based on this study, several design suggestions for water heaters have been made which are expected to improve long-term performance and efficiency of gas-fired water heaters.

NORMAL SODIUM CONSUMPTION

It is estimated that the average person consumes the equivalent of 2 to 3 teaspoons of salt per day from all sources. This is about 8 to 15 grams. Some of the salt is in the food naturally, but most of it is added in processing, preservation, cooking, and at the table. A salt (sodium chloride) intake of 8 to 15 grams is equal to about 3 to 6 grams (3,000 to 6,000 milligrams) of sodium.

An example of this daily intake may be as follows:

| FOOD | APPROXIMATE SODIUM CONTENT IN MILLIGRAMS |
|---|---|
| <u>Breakfast</u> | |
| ½ cup canned tomato juice | 439 |
| 1 egg (no salt added) | 59 |
| 2 slices of bacon | 274 |
| 2 biscuits | 350 |
| 2 teaspoons margarine | 140 |
| <u>Lunch</u> | |
| Sliced ham (3 oz.) | 1114 |
| Processed cheddar cheese (1 oz.) | 406 |
| 2 slices of white bread | 228 |
| 1 cup milk | 122 |
| 1 large olive | 80 |
| 1 dill pickle | 930 |
| 1 teaspoon of mustard | 65 |
| Potato chips, about 10 | 200 |
| <u>Dinner</u> | |
| 6 oz. Steak (no salt added) | 110 |
| Green salad, with 1 oz. French dressing | 450 |
| Baked potato (salt added) | 270 |
| 2 pats margarine | 140 |
| 2 slices (or equivalent) of rye bread | 278 |
| TOTAL SODIUM (milligrams) | 5,655 |

SODIUM IN SOFTENED WATER

Since sodium (NA+) is added to water softened by the cation exchange process (mechanical water softening), the level of sodium in softened water may be of interest to persons on sodium restricted diets.

The table below shows the amount of sodium (NA+) added to softened water of varying original hardness. The harder the water is originally; more sodium is added.

Formula for determining sodium (NA+) added to softened water:

For each grain of hardness removed by cation exchange water softening, 7.5 milligrams of sodium (NA+) per quart is added back to the softened water.

| Initial Water Hardness | Sodium Added to Water From Cation Exchange Softening | | |
|-------------------------------|---|---------------------------------|-------------------------------|
| | Milligrams NA+ per gallon | Milligrams NA+ per quart | Milligrams NA+ per cup |
| 1 | 30 | 7.5 | 2 |
| 3 | 88 | 22 | 5 |
| 5 | 148 | 37 | 9 |
| 7 | 208 | 52 | 13 |
| 10 | 300 | 75 | 19 |
| 15 | 447 | 112 | 28 |
| 20 | 600 | 150 | 37 |
| 25 | 448 | 187 | 47 |
| 30 | 900 | 225 | 56 |
| 35 | 1048 | 262 | 65 |
| 40 | 1200 | 300 | 75 |
| 45 | 1348 | 337 | 85 |