

## DRINKING WATER - HARD OR SOFT?

D V S S RAMAVTARAM\*

Water is essential for sustenance of life. The primary motive of drinking water supply is to protect human health by ensuring access to adequate quantities of safe water to one and all. Currently 1.1 billion people worldwide lack access to improved water sources, and 1.6 million children under the age five die each year from diseases brought on by lack of safe drinking water and adequate sanitation.

Processes as softening and stabilization, condition water to reduce piping corrosion and scaling effects in installations and improve consumer acceptability. Domestic points of entry ion exchange (water softeners) devices remove hardness (e.g. Calcium, magnesium) and iron and increase sodium content. (WHO/HSE/WSH/10.1/10/REV/1). Point of use water purifiers as reverse osmosis and distilling devices remove minerals, function as a barrier against potential trace levels and remove nutrients (Expert consensus, WHO 2009).

India tops bottled water industry globally, in spite of high unit prices. Global consumption of bottled water is nearing 200 billion liters/ year. In India bottled water consumption is increasing by as much as 50% annually, though being less than five liters/yr/person and India is the tenth largest bottled water consumer.

Internationally recognized standards for packaged bottled water are formulated by Codex Alimentarius Commission, jointly approved by WHO and FAO of the US. Separate standards exist for natural mineral waters (CAC 1977) and for bottled/package drinking waters (CAC 2001). WHO drinking water guidelines are the basis for derivation of the standards for all bottled/ packaged waters. Codex standards describe the product and its labeling, composition and quality factors, including limits for certain chemicals, hygiene and packaging, however these do not refer specifically to calcium or magnesium.

Proactive media advertising has prodded consumers to buy bottled water as an alternative to soft drinks and alcohols. Interestingly, even in countries where there is access to safe public drinking water, people spend up to 1000 times

more on a unit cost basis for bottled water than tap water. In countries as USA strict regulations exist for packaging bottled water as the FDA considers bottled water as food product and must meet applicable food packaging and quality regulations of the Food and Drug Administration, where as many other developed countries rules for bottled water are weaker than natural potable water regulations. The situation is worse in developing countries. For example, in India there is a general lack of standards for bottled water, hygiene requirements for the containers and a mandatory system for testing and monitoring bottled water quality and safety.

Historically, "drinking water" is regarded as free from pathogenic microbial and obvious anthropogenic or chemical contamination. Awareness of the importance of minerals and other beneficial constituents in drinking water has existed for thousands of years, being mentioned in the Vedas of ancient India. In the book Rig Vedas, the properties of good drinking water were described as follows: Sheetham (cold to touch), Sushihhi (clean), Sivam (should have nutritive value, requisite minerals and trace elements), Isthamb (transparent), Vimalamb lahu Shadgunamb (its acid base balance should be within normal limits)".

The fact that water may contain desirable substances has received scant attention in guidelines and regulations, but an increased awareness of the biological value of water has occurred in the past decades. It is a general belief earlier that such "clean" water was harmless. Typically, a few chemical elements are routinely analyzed for water quality in Asian countries and the analysis of calcium, zinc or magnesium are not routinely included on the regulatory monitoring list (Ong et al, 2009).

An important global issue remains the low mineral intake from foods and water. In both developed and developing countries there is a prevalence of subclinical deficiency of iron, magnesium, zinc and calcium. Mineral content of drinking water supplies from Asian countries generally range from 2-80 mg/L for calcium and <20 mg/L for magnesium. An inverse relationship between water hardness and

various diseases including coronary morbidity, cerebrovascular diseases and gastrointestinal cancers in Taiwan, China has been reported.

Packaged waters constitute an increasing drinking water source, in both developed and developing countries. Extreme variations in the mineral composition of packaged waters, with total dissolved solids ranging from almost zero to several thousand milligrams/L and similar variation in concentrations of essential elements exist. Surat Municipal Corporation provides civic amenities to the citizens of Surat and takes care of water supplies to the Surat city. Every day approximately 795-805 million liters of water after treatment is supplied to approximately 40 lakhs of people.

In the city of Surat and rural areas of Surat district mainly two types of filtration methods are in vogue, namely candle filter and reverse osmosis. Candle filter effectively removes chlorine, sediment and volatile organic compounds and minerals like  $\text{Ca}^{2+}$ ,  $\text{Mg}^{2+}$ , and  $\text{K}^{+}$ .

In a study conducted recently by us in Surat by including both urban and rural areas, water sources either natural or supplied by the corporation have desirable hardness, calcium and magnesium hardness. But a significant population, both rural and urban, is not consuming these hard water supplies owing to life styles. Reasons for this non consumption of hard water supplies is their own making as they are using the water filters which are not strictly adhered to maintain the purification standards with the maintenance of the desirable levels of total hardness and calcium and magnesium hardness and levels of other trace elements which are necessary for optimum health. An interesting finding of this study is low levels of hardness, calcium and magnesium hardness in the bottled waters of ten commercial suppliers and very low calcium hardness and zero magnesium hardness in one or two brands of commercial bottled.

While dealing with drinking water supplies the providers face the dilemma of conditioning and whether hard or soft is the better option? If we go for hard or soft water what extent of hardness or softness one has to maintain? Conditioning of water, including central

softening and stabilization, may be necessary to reduce corrosion of piping materials and scaling effects in installations and to improve consumer acceptability. Corrosion and scaling are associated with adverse effects on health, environment, reduced distribution and appliances lifespan. There are valid reasons for central softening of water like reduced exposure to trace metals due to reduced corrosion of plumbing in the distribution system, reduced costs because of reduced consumption of detergents, fewer discharges to the environment and better consumer comfort due to better looking clothes, glassware etc (Expert consensus, 2009).

Studies, mainly ecological epidemiological have documented inverse relationship between water hardness, CVS mortality, diseases as diabetes and sudden deaths. To maintain proper balance between hard and soft water, approaches require a separate hard water line to the kitchen sink, a small bypass to achieve target hardness levels in the cold water a new POU mineralization unit under the kitchen sink with a separate tap and to carry out the hot water softening only in lower-hardness areas.

It is time to make the distributors of piped water supplies and commercial bottled water suppliers to strictly adhere to the standards laid down for the total hardness, calcium and magnesium hardness and other essential elements. This is necessary as the water takes care of supply of essential elements like calcium, magnesium and others in addition to the dietary supplies. Another pertinent aspect of elements present in the water is their easy absorbability in comparison to the dietary elements. Administrators also should give a thought like inclusion of water in the category food supplies as done by the FDA. IEC activities on positive and negative aspects of hard and soft water and ensuring that manufacturers of installers and commercial bottled water suppliers provide adequate composition information to consumers are the need of the hour.

## REFERENCES

1. Expert consensus (2009): Meeting experts report, 1, 1-15
2. Expert consensus (2009): Water production, technical issues and economics, 12,154-165.

\*The author is Professor and Head of the Department of Biochemistry and Surat Municipal Inst. of Medical Education and Research and has extensively worked in this area.