



Hard water versus your skin

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Observational studies suggest that hard water is associated with the development of atopic dermatitis. Studies of children in the United Kingdom, Spain, and Japan show the prevalence of AD is significantly higher in the highest water-hardness categories than in the lowest. Calcium cations in water can interfere with normal epidermal calcium gradients that are necessary for corneocyte development and proper stratum corneum barrier formation.

Water hardness, determined by the amount of dissolved calcium and magnesium in the water, varies by geography and mineral content of the water supply. The hardest water supply in the United States is mostly localized to the Upper Plains and Rocky Mountain areas. General guidelines for classification of waters are as follows: 0-60 mg/L calcium carbonate (soft), 61-120 mg/L (moderately hard), 121-180 mg/L (hard), and more than 180 mg/L (very hard). In regions where there is hard water, the surfactants in soap, such as sodium dodecyl sulfate, react with the calcium and magnesium ions in hard water, resulting in precipitation of the surfactant – leaving a film of residue on the skin, shower

tiles, pipes, glassware, etc.

Maibach et al. also described water as a contact irritant, particularly under occlusion. Skin occluded with water has increased histopathologic inflammation, scaling, and barrier breakdown. In addition to its mineral content, pH, temperature, and osmolarity can be contributing factors to the irritancy of water. However, compared with soft water, skin exposed to hard water has increased dilution of the natural moisturizing factors and alteration of the corneocyte layers, resulting in increased disruption of the protective epidermal barrier.

Atopic dermatitis, xerosis, and pruritus are some of the common skin reactions to hard water. Other less well-defined effects on the skin include clogged pores and acne from surfactant residue left on the skin and altered sebum production. In addition, more surfactants or cleansers are needed to clean the skin and hair in areas with hard water because the abundant cations require a much heavier lather to dissolve.

Calcium and magnesium cations left on the skin can also form free radicals. Free radicals over time can result in collagen and elastin breakdown and in the increased prevalence of fine lines and wrinkles.

Although there is no definitive solution to geographic increases of water mineral content, water softeners have

grown in popularity over the last decade and in my practice are recommended to anyone with atopic dermatitis that is resistant to treatment or is recalcitrant.

These home appliances work through an ion-exchange system in which a resin or organic polymer replaces the magnesium and calcium in the water with sodium or potassium cations. When all the sodium or potassium ions have been replaced in the resin, the resin is then “recharged” with a solution of sodium hydroxide (lye) or potassium hydroxide. Alternative less popular softening techniques include lime softening, chelating agents, distillation, and reverse osmosis.

Hard water and geography should be considered as a possible factor when assessing patients with recalcitrant eczema, pruritus, or xerosis that cannot otherwise be reversed. Water-softening treatments are a simple solution in areas where the mineral content of water is elevated or the water plays a role in clinical skin disease. ■

References

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