

Hard water linked to risk of eczema in infants

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Credit: Anna Langova/public domain

High levels of water hardness in the home may be linked to the development of eczema early in life, according to a new study led by King's College London.

Eczema affects around a fifth of children in the UK. Skin barrier impairment and dry skin are thought to be triggers of eczema in early

life, partly through genetic predisposition. Environmental factors may also contribute to the breakdown of the skin barrier, including water hardness and chlorine in household water. In the UK, domestic water tends to be harder in the south compared to the north, and the prevalence of eczema follows the same gradient.

Previous studies in the UK, Spain and Japan have shown associations between domestic water hardness and the risk of eczema in schoolchildren. However, the link between water hardness and eczema has not been studied in early infancy.

The latest study, published in the *Journal of Allergy and Clinical Immunology*, examined the link between water hardness and chlorine concentrations in household water, damage to the skin's natural barrier and eczema in infancy.

Researchers recruited 1,300 three-month old infants from families across the UK taking part in the [EAT study](#) and gathered data on levels of calcium carbonate (i.e. water hardness) and chlorine in their household water from local water suppliers.

The infants were checked for atopic dermatitis ([childhood eczema](#)) and their skin's barrier function was assessed by measuring transepidermal water loss (TEWL) on the skin of an unaffected forearm. Infants were also screened for mutations in the filaggrin (FLG) gene, which codes for a key skin barrier protein. Mutations in the FLG gene result in an impaired skin barrier, which is thought to allow allergens to penetrate the skin and predispose the body towards an allergic response. Information on the use of a water softener in the home, frequency of bathing and use of moisturizers and bath products was also collected.

Living in a hard water area was associated with an up to 87% increased risk of eczema at three months of age, independent of domestic water

chlorine content. The risk tended to be higher in children with mutations in the FLG skin barrier gene, although these latter results were not statistically significant.

Although the study attempted to account for potential confounding factors, such as bathing frequency and the use of soaps and shampoos, skin care and hygiene practices could have already changed by the time of enrolment into the study due to the early emergence of eczema or dry skin. The study also did not have information on children's exposure to swimming pools, which contain much higher chlorine levels than domestic water and could have an additional detrimental effect on skin barrier function and risk of eczema.

Dr Carsten Flohr, lead author from St John's Institute of Dermatology at King's College London and Guy's and St Thomas' NHS Foundation Trust said: "Our study builds on growing evidence of a link between exposure to hard water and the risk of developing eczema in childhood. It's not yet clear whether calcium carbonate has a direct detrimental effect on the skin barrier, or whether other environmental factors directly related to water hardness, such as the water's pH, may be responsible."

"Interactions between hardness and chlorine levels, other chemical water constituents and the skin's microflora may also play a role, and this warrants further research. We are about to launch a feasibility trial to assess whether installing a water softener in the homes of high risk children around the time of birth may reduce the risk of eczema and whether reducing chlorine levels brings any additional benefits."

Dr Michael Perkin, first author from St George's, University of London (and previously at King's College London) said: "The EAT study recruited infants from throughout England and Wales. Having studied this group of children so meticulously, we are able to look at geographically disparate factors like water hardness and chlorine levels

in this unique cohort."

The research team has recently received funding through a NIHR Career Development Award to Dr Flohr to study the effect of water hardness on the neonatal skin in more detail. Preparations are underway to establish whether installing a device to lower water hardness in households around the time of birth can reduce the risk of an infant developing eczema; recruitment into this new study will commence later this year.

Minister for Life Sciences, George Freeman, MP said: "Eczema can be a painful and distressing condition and by investing in funding for research to develop a better understanding of the link between water hardness and [eczema](#), I hope we can help prevent further suffering for thousands of children.

"Through our commitment to investing £1bn every year of this parliament into the National Institute for Health Research, we're funding world class medical breakthroughs which can improve NHS patient outcomes and help avoid unnecessary NHS treatment costs."

More information: Michael R. Perkin et al, The Association between Domestic Water Hardness, Chlorine and Atopic Dermatitis Risk in Early Life: A Population-Based Cross-Sectional Study, *Journal of Allergy and Clinical Immunology* (2016). [DOI: 10.1016/j.jaci.2016.03.031](https://doi.org/10.1016/j.jaci.2016.03.031)

Provided by King's College London

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