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## Water and adult eczema: the hard truth?

Linked Article: Lopez *et al.* *Br J Dermatol* 2022; doi:10.1111/bjd.21771

The pathogenesis of atopic dermatitis (AD) is multifactorial, with a complex interplay between genetic, immune and environmental risk factors.<sup>1</sup> One of the environmental factors is domestic hard water.<sup>1</sup> All epidemiological studies on this topic have a focus on infants or school-age children, with the majority reporting a higher prevalence of AD in areas with hard water.<sup>2–4</sup> However, this association has not been examined in adults.

In this issue of the *BJD*, Lopez *et al.* investigated the association of domestic hard water, as measured by CaCO<sub>3</sub> concentrations, with prevalent eczema at baseline (2006–10) and follow-up (2013–14) and eczema incidence (new onset of eczema between baseline and follow-up) in adults aged 40–69 years using data from the UK Biobank study.<sup>5</sup> In total, 306 531 participants were included in the baseline analysis; of these, 10.1% were included in the follow-up analysis.

Firstly, the authors found that higher exposure to domestic hard water was positively associated with increased eczema prevalence at baseline. The question now is whether the association found between water hardness and eczema in adults reflects a true association, and how to interpret these results. In this study, participants with eczema were identified if they self-reported both eczema and current use of eczema medications. This definition potentially leads to a patient population including all types of eczema, while previous studies in the paediatric population were restricted to AD.<sup>2–4</sup>

A mechanism underlying the association between water hardness and AD in infants and school-age children is the deleterious effects of hard water on skin barrier function, especially among those with loss-of-function mutation of the filaggrin gene.<sup>6</sup> Considering the inclusion of adult patients with all types of eczema, not only AD, in this study, the effect of filaggrin loss-of-function mutations on the risk of eczema might not be the main explanation. As such, how can the observed association be explained in adults? An increase in the deposition of detergents such as sodium lauryl sulfate on the skin, elevated skin-surface pH, and altered calcium signalling in the epidermis may contribute to this association.<sup>7</sup> In addition, more soap is needed to obtain lather when washing in hard water, which might also cause skin barrier impairment.<sup>2</sup>

Considering these mechanisms, domestic hard water has the potential to worsen the disease severity of patients with existing eczema, which was not addressed in this study. Notably, the authors did not adjust for the usage of water softeners in the analysis. Given that those with eczema are likely to employ protective methods, such as using water softeners, to protect their skin, we do not know whether

an additional adjustment of water softeners would alter the found association.

Secondly, the authors found no association of water hardness with prevalent eczema at follow-up and eczema incidence. As mentioned in this publication, there was a substantial and selective reduction in participants at follow-up, with participants lost to follow-up tending to live in areas with hard water. This possibly decreased the power of the statistical analysis, suggesting that these results should be interpreted with caution.

Taken together, what is clear from this publication is that a higher prevalence of eczema in adults was observed in areas with hard water, but we cannot draw any conclusions regarding eczema incidence. In addition, it would be of interest for further studies to utilize more specific definitions of eczema such as AD, and also to explore the effect of hard water on disease severity.

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