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Consumption of water containing over 3.5 mg of dissolved hydrogen could improve vascular endothelial function

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Abstract

Background: The redox imbalance between nitric oxide and superoxide generated in the endothelium is thought to play a pivotal role in the development of endothelial dysfunction. A third reactive oxygen species (ROS), H₂O₂, is known to have both beneficial and detrimental effects on the vasculature. Nonetheless, the influence of the hydroxyl radical, a byproduct of H₂O₂ decay, is unclear, and there is no direct evidence that the hydroxyl radical impairs endothelial function in conduit arteries. Molecular hydrogen (H₂) neutralizes detrimental ROS, especially the hydroxyl radical.

Objectives: To assess the influence of the hydroxyl radical on the endothelium and to confirm that a gaseous antioxidant, H₂, can be a useful modulator of blood vessel function.

Methods: The efficacy of water containing a high concentration of H₂ was tested by measuring flow-mediated dilation (FMD) of the brachial artery (BA). The subjects were randomly divided into two groups: the high-H₂ group, who drank high-H₂ water containing 7 ppm H₂ (3.5 mg H₂ in 500 mL water); and the placebo group. Endothelial function was evaluated by measuring the FMD of the BA. After measurement of diameter of the BA and FMD at baseline, volunteers drank the high-H₂ water or placebo water immediately and with a 30-minute interval; FMD was compared to baseline.

Results: FMD increased in the high-H₂ group (eight males; eight females) from 6.80%±1.96% to 7.64%±1.68% (mean ± standard deviation) and decreased from 8.07%±2.41% to 6.87%±2.94% in the placebo group (ten males; eight females). The ratio to the baseline in the changes of FMD showed significant improvement (P<0.05) in the high-H₂ group compared to the placebo group.

Conclusion: H₂ may protect the vasculature from shear stress-derived detrimental ROS, such as the hydroxyl radical, by maintaining the nitric oxide-mediated vasomotor response.

Keywords: 5–7 ppm; flow-mediated dilation; hydroxyl radical; molecular hydrogen; peroxynitrite; reactive oxygen species.

Figures

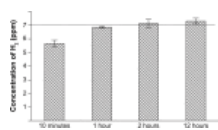


Figure 1 Concentration of H₂ in...

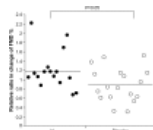


Figure 2 Effects of high-H₂ water...

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